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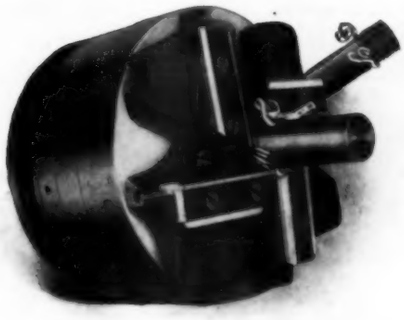
Landis Dies



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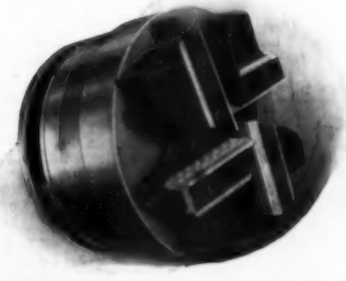

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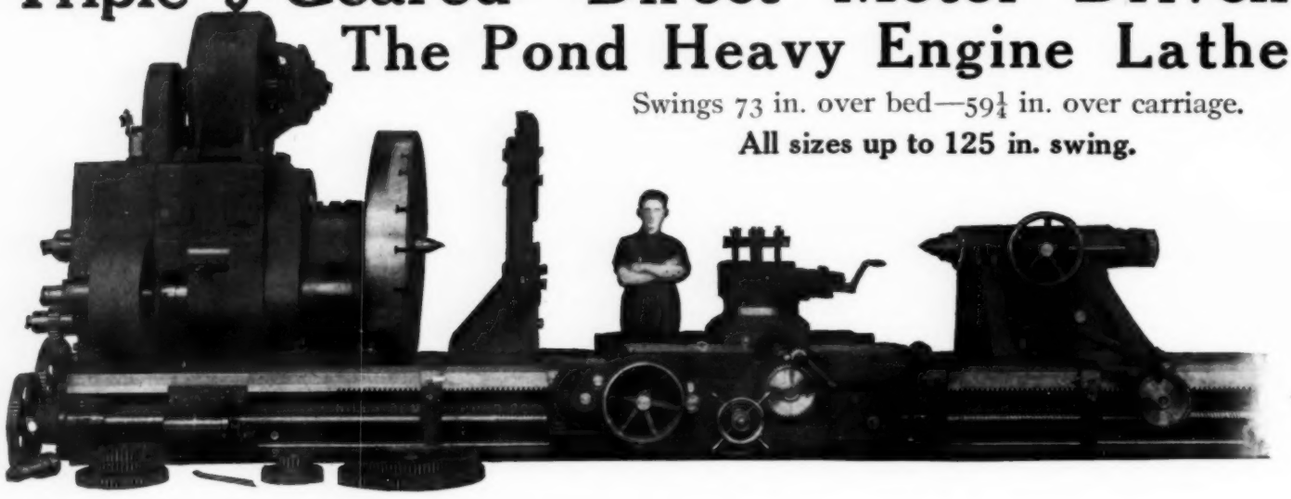

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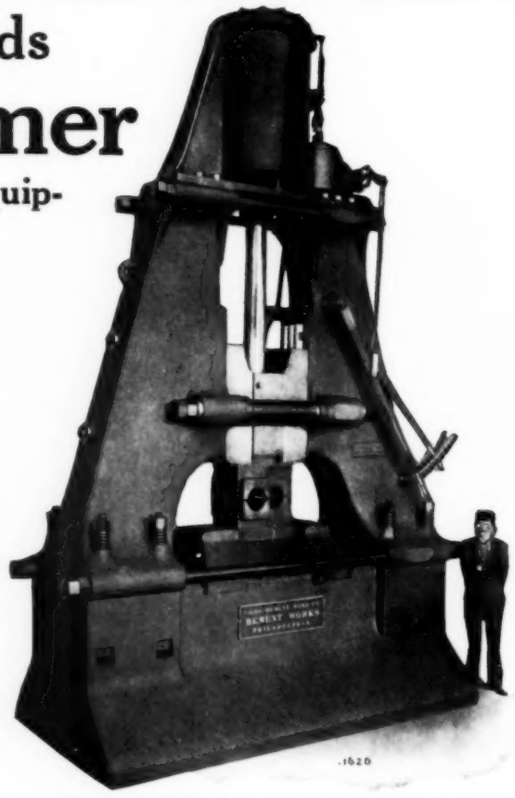

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(*See pages* 43, 44, 45, 46 *and* 47)

Making Patterns from Oiled Sand

Editorial Correspondence

A new method and new material for pattern making, namely, oiled sand. Patterns made from it have been used for over 100 castings. Patterns are built up on slabs for molding the outside of iron core boxes. Cores are made similar to the patterns, on slabs of the same size, so they will drop into the mold, core out the inside of the iron core boxes and last as long as the pattern.

The brass injector bodies and the numerous intricate cores that are required for casting them. A casting sawed open to show the quality of the work.

The special brass melting furnace that is used in the foundry.

If one were to tell the wood- or metal-pattern maker that patterns were being made from sand and that these were being used successfully for the making of brass and iron castings, they would doubtless laugh at the statement as not being worthy of their consideration. Or they might emphatically assert that such material could not be used for this purpose.

However this may be, oiled sand, such as is used for core making, is being used to manufacture patterns in the injector department of William Sellers & Co., Philadelphia. Strickland Kneass, the manager of this department, has developed this process to a point where the sand patterns have been used for making over 100 castings without showing any wear, and he claims that a saving of as much as 40 per cent. has been made in some kinds of patterns.

The sand used is composed of one part oil to 70 parts sand, which are thoroughly mixed so that each grain of sand will be covered with a film of oli. This, when baked, will cause the liquid to dry up and leave the grains of sand covered with a pasty material that causes them to adhere together and make a solid mass that is quite difficult to break.

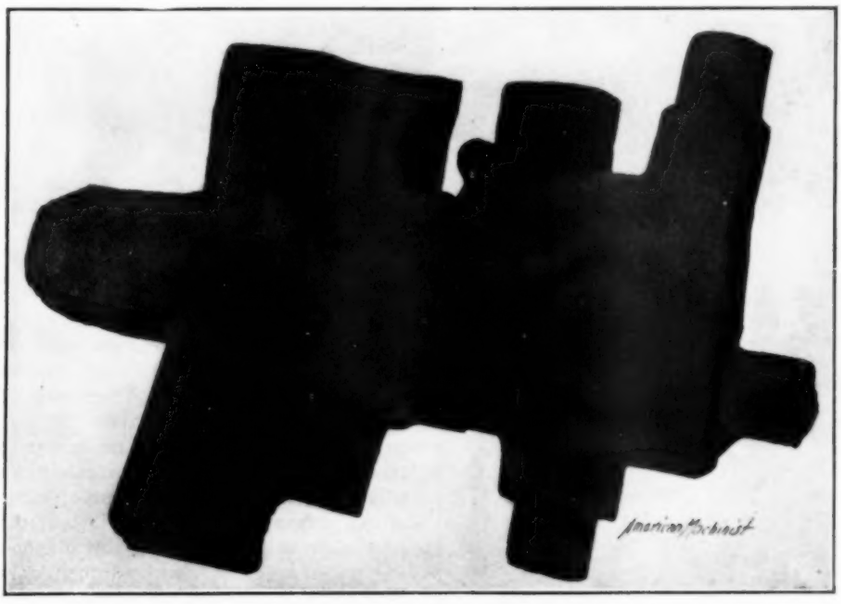


FIG. 1. BLOCK OF OIL SAND FOR PATTERN AS MADE IN SAND MOLD

OIL SAND BLOCK AS FORMED IN WET SAND MOLD

In Fig. 1 is shown the result of the first operation in this method of patternmaking. It was started when it was difficult to obtain patternmakers and also difficult to get a pattern out of their regular pattern shop in any reasonable time. Being in a hurry for a pattern, Mr. Kneass, when the idea suggested itself, took a skilled fitter (or vise hand) that was capable of doing a little thinking and put him to working out this proposition, with the result that today quite complicated patterns are being made by men who have not served their time as regular patternmakers.

To make the block shown in Fig. 1, an ordinary drag flask is taken and sand is filled in it and packed by hand, so it will leave an impression somewhere near the shape and size of the pattern that is to be made. This is done in the core room and the oiled sand used in making cores is then filled into this impression. The whole is then dumped out on a drying plate and the molding sand removed, which leaves a chunk of sand similar to that shown. This is then put into the core oven and baked.

After being thoroughly dried out, it is fairly hard and is formed to the shape of the pattern desired. Bosses, core prints, etc., can be added to it and it can be sawed very similar to the way in which wooden patterns are cut to form. After adding sand to the block shown, in order to make parts of the pattern that are not allowed for, it must again be baked in order to make the fresh sand part as hard as the original block and tightly joined to it.

PATTERN MADE FROM BLOCK

In Fig. 2 are shown the two halves of the pattern that was made from the block shown in Fig. 1. It will be noted that the corners are all as sharp as though the pattern were made of metal or wood. When the last coat of varnish has been given it, it looks so much like a blackened wooden pattern, that it is difficult to tell the difference; in fact, we had to dig a hole in the pattern to convince the photographer that it was made of sand.

The only parts of this pattern that are not sand are the core prints *A*, *B*, *C* and *D*, which are turned from brass and inserted in the sand; the draw plates similar to those shown at *E* and *F*; and the double pins and their plates, which are inserted in the sand on the back of the two halves of the pattern as shown.

OTHER PATTERNS

In Fig. 3 are shown two other complete patterns that are made of oil sand. These are parted on the center line and made in two halves like the pattern shown in Fig. 2.

The above three patterns show the largest and most complicated shapes that have been made from oil sand, but many smaller and simpler ones have been made and are being used.

The pattern shown in Fig. 2 has been used to make the molds for over 100 castings, and as can be seen, it apparently shows no wear and looks as though it might stand up for many more castings. If broken in any place or worn on the corners, the material is such that the pattern can easily be patched or new parts built on.

Most of the work on these patterns is done with old files for tools; these being ground into the shapes required. The band saw is also frequently used in shaping up the blocks shown in Fig. 1, and broken band saws are cut up into short lengths and used as hand saws. Sometimes core prints, flanges, etc., are turned up in the lathe and added to the patterns. When the shape is completed the pattern is given a coat of filler, the

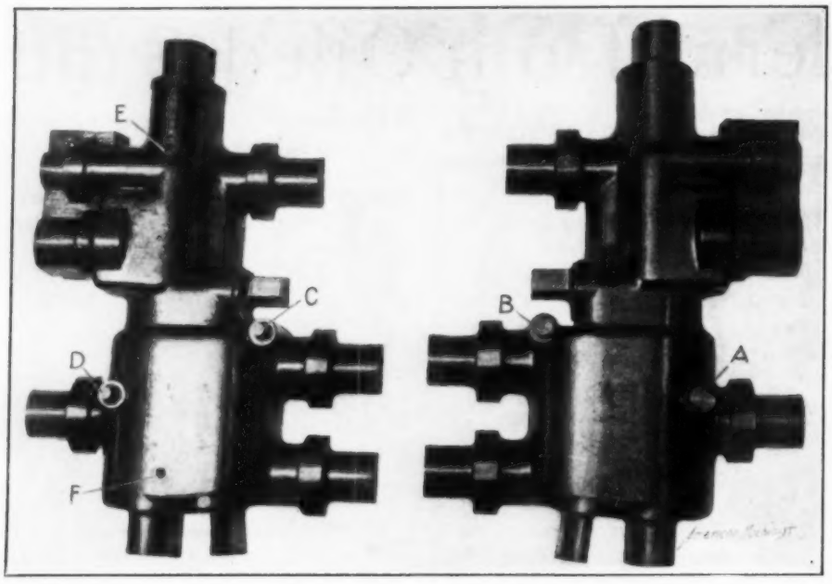


FIG. 2. TWO HALVES OF PATTERN MADE FROM OIL-SAND BLOCK IN FIG. 1.

same as the wooden patterns would be given and this rubbed down smooth and a coat of black put on over it. After this it can be rubbed down and shellacked as many times as desired to get a perfectly smooth surface. With it no shrinking, swelling or warping occurs and no glued joints are in the pattern to bother the molder.

IRON CORE-BOX PATTERNS

In Fig. 4 are shown some sand patterns for making iron core boxes, and in Fig. 5 will be seen iron boxes that were cast from these or similar patterns. The sand patterns in Fig. 4 are typical of many that have been made for this purpose.

In making the iron core box *N*, in Fig. 5, a mold is made from sand patterns *G* to form the outside of the box and then pattern or permanent core *H* is dropped into the mold and left there to give the inside of the box its proper shape. Sand pattern *M* shows plainly the kind of iron core box that will be cast from it, but the casting is shown at *O*. Sand patterns *I*, *J*, *K* and *L* are used to make core boxes similar to those shown at *P*, *Q* and *R*. While iron core boxes *S* and *T* were made from sand patterns, the patterns were in use and hence could not be shown in Fig. 4.

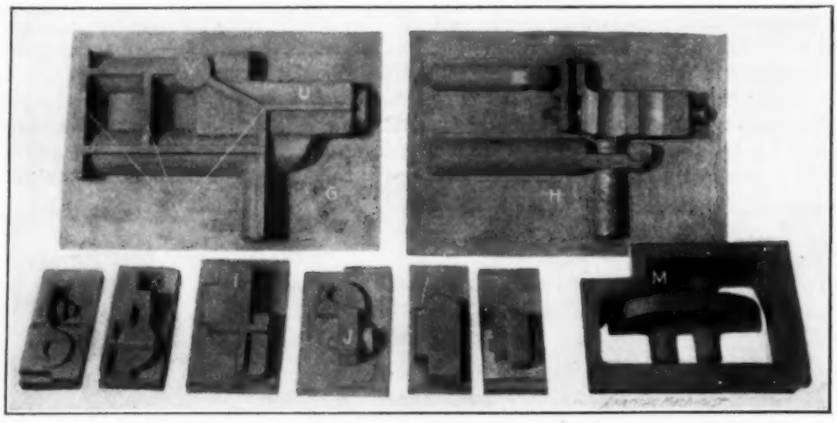


FIG. 4. OIL-SAND PATTERNS FROM WHICH IRON CORE BOXES ARE CAST

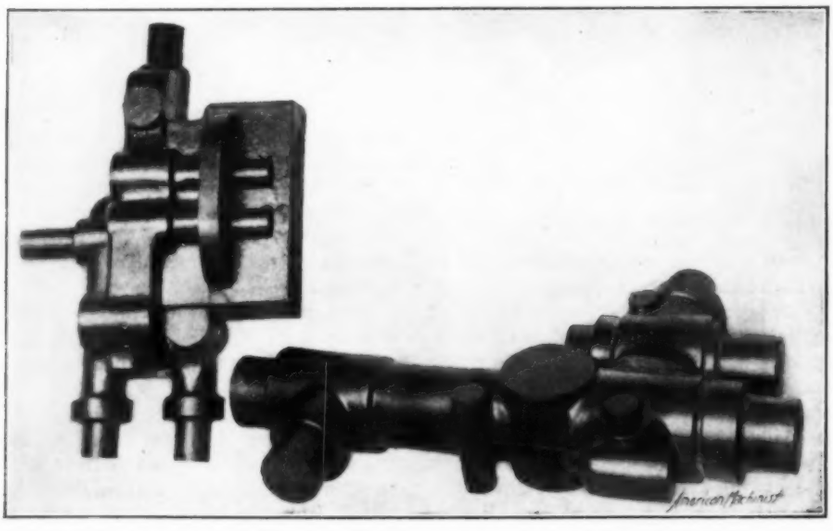


FIG. 3. TWO COMPLETE PATTERNS MADE FROM OIL SAND FOR BRASS CASTINGS

BUILT-UP SAND PATTERNS

In making the sand patterns, shown at *G*, to form the outside of the box and at *H* to form the inside, it was the easier way to build them up in much the same manner that one would a wooden pattern.

A slab of sand was taken, instead of a board, and the flat, oblong section *U* was placed on it. The half-round sections were then turned and fitted to this oblong block and located in place. Boss *V* was next fitted on. Flat slabs of oil sand were then made the proper thickness for ribs *W*, and these were cut and fitted to place the same as wooden pieces would be. The whole was then filled, blacked and shellacked the same as the pattern shown in Fig. 2.

The pattern *H*, which forms the core or inside of iron box *N*, is made exactly to size and shape with the exception of allowing for shrinkage. When the iron box is cast it is then only necessary to take off the high spots and clean it up with a file in order for it to make cores of the proper size and shape. All of the iron core boxes made by this method are made to exact size and then only filed clean.

INJECTOR AND SOME CORE BOXES

In Fig. 7 is shown one of the large double-injector bodies that is made by William Sellers & Co., and this is cut open in order to show the numerous passages that have to be taken care of by coring. It is probably one of the most intricate brass castings that is made and requires many entangling core boxes, as well as skilled core makers and molders to get good castings.

An idea of the coring can be obtained from Fig. 6, in which some of the boxes

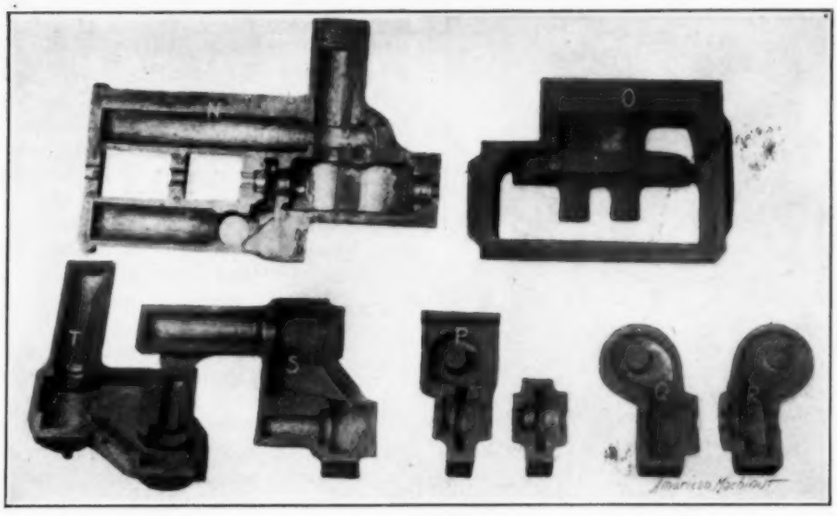


FIG. 5. CAST-IRON CORE BOXES MADE FROM OIL-SAND PATTERNS

that are used are shown. This includes only about one-half of the boxes, and in some cases but one-half of each box is shown.

After filling core box *A* with sand, loose pieces *B*, *C* and *D* are placed in position to complete the shape of the core. This makes it look like box *E*, which is the opposite hand of the same core.

In the core box shown at *F*, the core is made with the loose piece *G* in position to cover up the opening at *I*. This is then removed and after the core has been rammed up in the box *H*, boxes *H* and *F* are clamped together so the two can be joined and made into one core.

In making the core in box *J*, loose piece *K* is used to cover the opening at *L* and form a rib in the casting. Another half core of the opposite hand is made in a similar box and these two joined into one core. This method is also employed on boxes *M* and *N*, which have loose pieces to form ribs.

CASTINGS OBTAINED

The success with which this method of pattern making, core making and molding is used, as well as the skill of the workmen, is well illustrated in Fig. 8. This shows a casting that has been sawed through in various places to see that a good metal has been obtained and that each wall has its correct thickness. The evenness of the wall thicknesses and the nonappearance of any blow holes, porous or spongy places, proves that a good quality of castings is obtained.

BRASS-MELTING FURNACE

This injector department has its own brass foundry and they use two melting furnaces of their own design. These are coke-burning furnaces and are shown in Fig. 9. The bottom of the furnace *O* is raised and lowered by compressed air and slides on the guide *P*, which is not fastened to the floor. It may be easily drawn out and metal removed in case of breakage of melting pots. It is shown lowered at *Q*, ready for building the coke fire. When this is done the air valve *R* is turned and this presses the bottom up against the body of the furnace, as shown at *O*. The cover-raising and swinging apparatus is a feature of this furnace. Pulling down on the lever *S* raises the cover up from the furnace body and it can then be swung either to the right or left on the shaft *T*. In the furnace to the left of the halftone the lever is shown in the position it occupies after the cover has been swung over the furnace and lowered into position. The supports, and the tilting mechanism, are so plainly shown that it is unnecessary to describe them. Each furnace has a

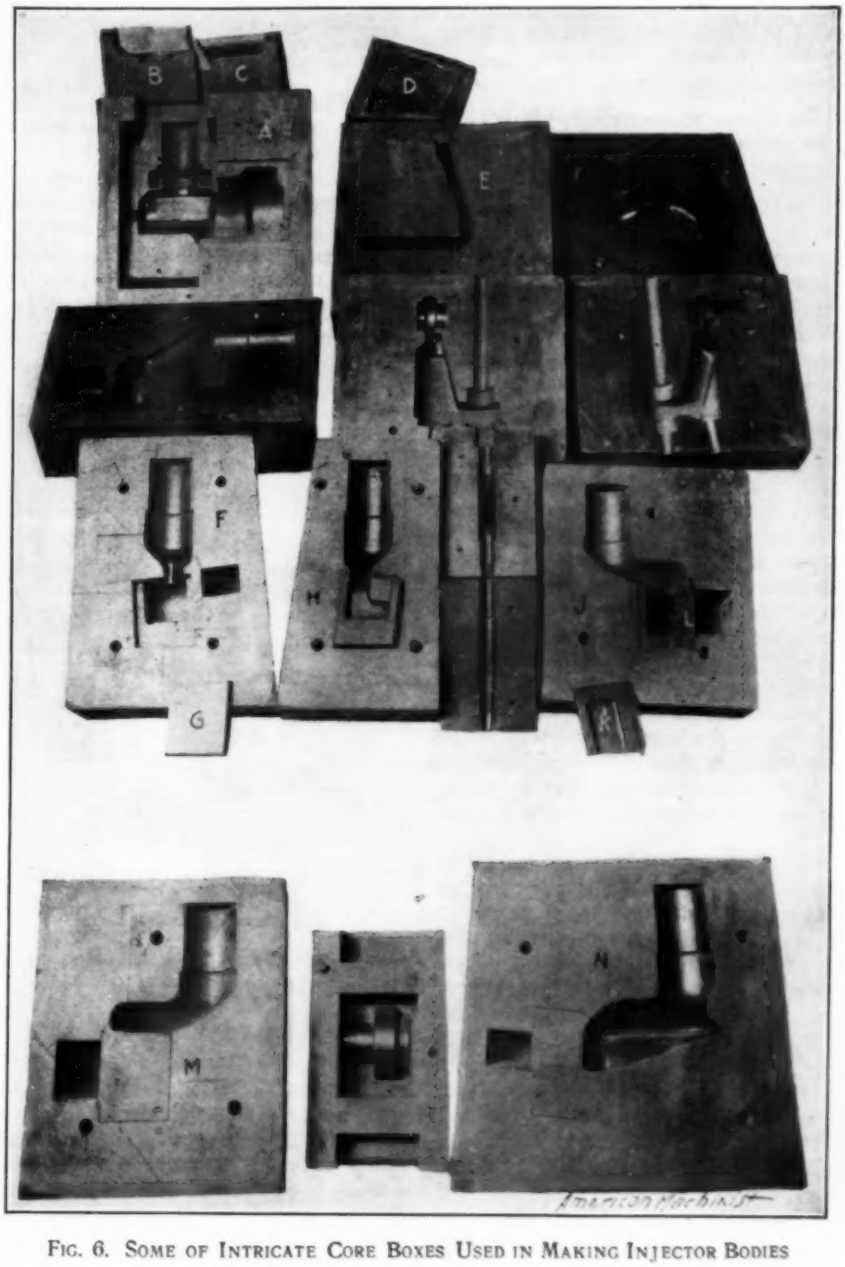


FIG. 6. SOME OF INTRICATE CORE BOXES USED IN MAKING INJECTOR BODIES

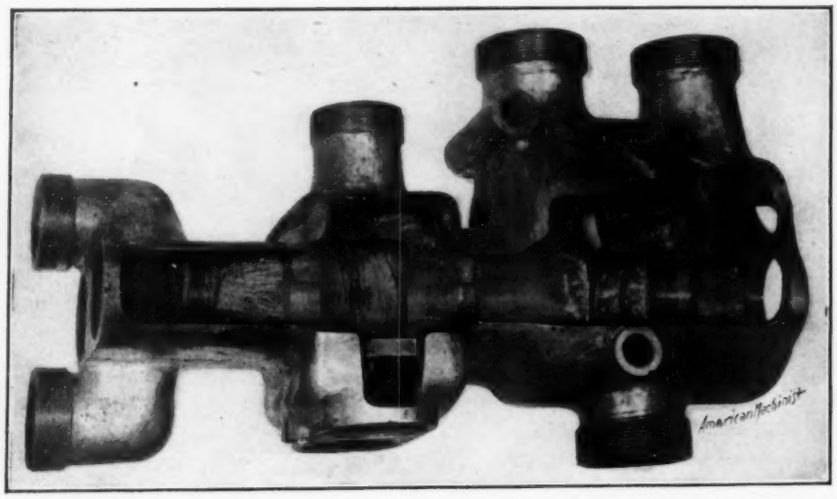


FIG. 7. INJECTOR BODY CUT OPEN AND SHOWING DIFFICULT CORE WORK

sheet metal hood over it and this is connected to piping that carries the smoke, gases and fumes to the outside.

The Cancelation of Orders

BY A. S. ALESMAN

In reference to the "order cancelation evil," to which the AMERICAN MACHINIST has recently given considerable space, it is interesting to note in the light of recent events that the practice of placing orders for machine tools months in advance of actual delivery seems to be increasing rather than diminishing.

A few months ago, the buyer who had use for certain types of machine tools, was told by the makers that no orders could be accepted for delivery under twelve to eighteen months. Today the buyer is told that he can get delivery in thirty days, and in many cases at once.

Does this mean that machine-tool makers willingly favor the buyer who may need a machine in six months rather than the man who actually had need for the machine and is suffering loss by reason of his inability to get one? This would seem to be the case, if one may judge from many machine-tool salesmen who, when the demand is brisk, urge the buyer to "put in his reservation" before it is too late.

To the outsider, it seems incredible that the machine-tool builder will accept orders for practically a year's output of his plant without some understanding with his customers that deliveries will be accepted when the machines are ready; otherwise, how can the builder distinguish between the *bona-fide* and the conditional purchaser? It would seem purely a point of justice that the former should receive preferment.

That the *bona-fide* buyer does not get preferment is a fact that is readily verified when the demand "eases up" and the blame would seem to rest almost entirely upon the sales manager who permits his sales force to teach the buyer to regard his order in the light of a "reservation" rather than a definite purchase order.

In defense of the sales manager, it may possibly be claimed that he instructs his salesmen to accept nothing but outright orders and that the fault is directly attributable to the desire of the salesmen to "make a showing." However this may be, this tendency of the salesman toward quantity rather than quality in order getting is unquestionably the seat of a large part of the difficulty.

EDUCATE THE SALESMAN

Every user of machine tools undoubtedly can tell of instances in which he has been induced by salesmen to place orders for future delivery on the salesman's assurance that he need not take delivery if he finds he does not need the machine when it is ready for shipment. Nine times out of ten, however, the salesman will keep this agreement or understanding off the order sheet with the explanation that it is not "necessary" and that he will personally see that it is "all right." The sales manager, knowing nothing of this agreement, assumes the order to be *bona-fide* and when it is canceled calls in the salesman who has made the sale. The latter, to save his own face, will recommend that the cancelation be accepted with good grace, giving the excuse that it is advisable to remain on good terms with the customer.

It is easier to criticize than to cure, but it would seem that the most effective way to stop the spread of the cancelation practice would be to begin with the salesman. If the latter, in a heart-to-heart talk with the sales manager, is made to understand that only straight orders will be accepted (verbal and written reservations barred) not only will his backbone be stiffened in respect to the "sticking quality" of his orders, but he will get added confidence in his line.

It should not be a difficult matter to impress on the buyer that an order once given cannot be canceled, and while in good times the monthly showing of the sales department may not be so rosy in the face of a stiff-backed policy, the demand from *bona-fide* buyers is usually large enough to keep the shop going, and that is all the manufacturer asks.

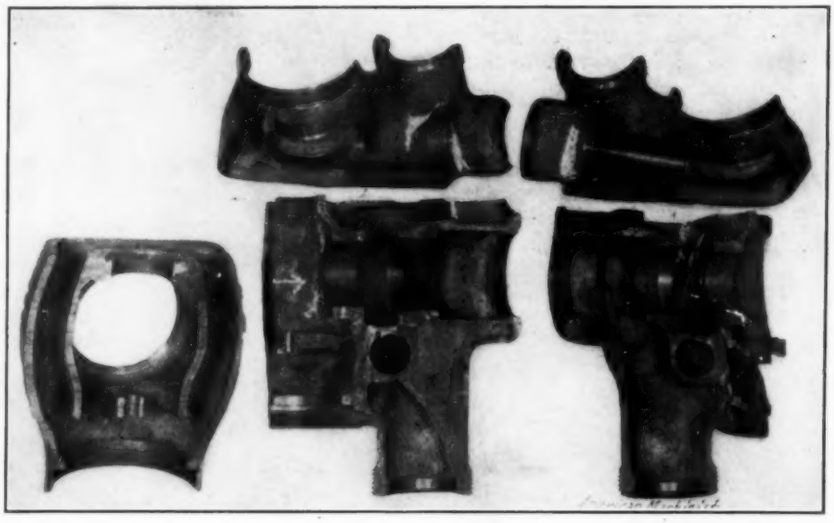


FIG. 8. CASTING SAWED UP TO SHOW THICKNESS OF METAL AROUND THE INTRICATE CORES

The suggestion that some kind of an advance payment plan be adopted by machine-tool builders has the appearance of a good form of protection, but in practice it is doubtful whether it would survive many weeks of enforcement. The average maker doesn't want his customers to forfeit deposits but to buy his tools, and the best way to accomplish this result is to hunt for the orders that have no strings attached to them. This may involve more persistent selling work, but

FIG. 9. SPECIAL MELTING FURNACE DESIGNED FOR USE IN BRASS FOUNDRY

it is better than to build up a vast superstructure of speculative business and have it reduced to an ashheap when dull times come on.

ENFORCED SPECULATION

The average buyer of machinery is not the deep-dyed speculator he has been represented to be. When he places an order for a tool for delivery in eight to twelve months from date of order, the chances are strong that he has been influenced in this action by the salesman who takes his order. Few buyers can or will look ahead to this extent unless they know that, if necessary, they can get out of their obligation to take delivery and therefore take the view that speculation of this kind presents a legitimate possibility of some gain at a future date with no chance of serious loss.

The machine-tool builder on the other hand must look ahead in quite a different way. He must arrange for the necessary manufacturing space and contract for his raw materials, and when wholesale cancelations of his orders set in, it is a more difficult matter for him to readjust his affairs.

Isn't the present a good time for machinery manufacturers to make an investigation of their sales departments, with a view to finding out just how much of the cancelation evil is due to their own employees?

Combined Forging and Punching Die

By H. E. Chittenden

A simple and efficient form of die for making connecting rods both economically and rapidly.

The accompanying line cut shows a successful and quick way for making a style of connecting rod used on a type of machine manufactured in large quantities by us. The rods are made from 1-inch round high-carbon steel. About 8 inches of the stock is upset on each end in the form of a round, flat boss.

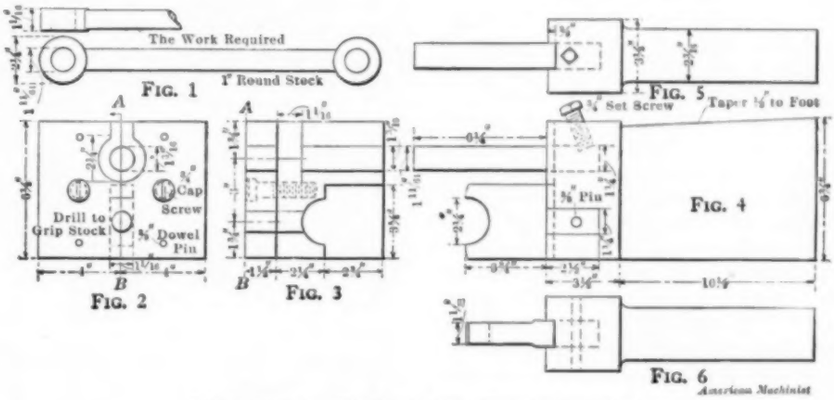
The heading machine is powerful enough to upset it at one blow but the stock will not upset even, that is, it makes a large surplus or flash of stock on one side and does not fill to shape on the other. This makes it necessary to take two or three blows to form a good shape.

In operating the dies shown, the stock is heated to a welding heat and dipped in borax before each blow. After the boss has been formed it is replaced in the fire and heated to a high temperature and then inserted in the top of the die and punched. The die shown has been in successful operation for about four years and has finished in that time over 2000 complete rods.

To be perfectly fair I should state that this job is not what you would call a fine piece of work. The main object of the connecting rod is strength as it takes the direct pull of a 30-horsepower engine. We have yet to record our first breakage.

DETAILS OF THE DIE

Referring to the line cut, Fig. 1 is the work required. Fig. 2 is a back view of the pair of dies as they appear when together in the machine. These dies consist of two parts, a cast-iron body and a hardened cast-steel back 1½ inches thick that are fastened together by a ¾-inch cap screw and two ⅜ dowel pins. The steel back forms the punch block or die against which the boss is punched. Fig. 3 is a face view of one of the dies that shows where the stock is upset in the bottom section and punched by inserting the boss in the top section. Fig. 4 shows the cast-iron head that carries the necessary tools which are of hardened cast steel. Fig. 5 is a top view of the head showing the punch. Fig. 6 is a bottom view of the head showing the upsetting tool.



COMBINATION FORGING AND PUNCHING DIE

The Various Elements of Cost

By Holden A. Evans*

The importance of accuracy in obtaining the direct labor charges and direct material charges cannot be over emphasized. All of the indirect costs must be obtained before the total factory cost can be summed up. Depreciation a much discussed and little understood element.

*Naval constructor, United States Navy.

It is well to admit, before going into the subject in detail, that from the point of view of the manager it is impracticable to obtain costs that are scientifically correct. To obtain such costs will require machinery so vast and complex that the real reason for the existence of the factory, that is, the production of work at a cost which will permit it to be sold at a profit, may be lost sight of in striving for scientifically accurate records.

In a few words, the purpose of costs is twofold: The first is to furnish the cost of the products so that the selling price can be fixed, or if the selling price is fixed by competition, to determine if the product can be manufactured at a profit. The second is for the benefit of the manager, to show him where economies may be effected.

Any information which is useful for these two purposes is valuable and should be obtained if this can be done without excessive cost or disadvantages which outweigh the advantages. Reports and data which do not serve either of these ends are useless, an unnecessary expense, and may by their complication and multiplicity of detail obscure the real objects sought.

In the present day with the systems of shop management which are most generally used, it is not possible to obtain costs with the degree of accuracy that is believed necessary by many progressive managers, but with advancement in shop management there will be corresponding advancement in the degree of accuracy of costs. I believe that the day is not far distant when scientific shop management will be almost universal and when that day comes, costs which are approximately scientifically correct will not only be possible but the rule. In the meantime great improvement can be made in existing methods, and it is the purpose of this series of articles to attempt to point out defects in methods frequently followed, and to attempt to describe methods which will give more accurate results, and at the same time not require an undue amount of clerical labor. The most important object sought, however, is to arouse interest among engineers, owners and managers in the importance of improvement in the accuracy of cost records.

Production costs consist of direct labor, direct material, and the indirect costs. It is difficult to give a general, but rigid, definition of these elements, but in each system at least, there must be a rigid definition if accuracy is to be attained.

Direct Labor

Direct labor is often called productive labor and is defined as all labor which is employed directly in the production of the output, as distinguished from labor indirectly employed on output. A machinist running a lathe turning a crank shaft for an engine under construction is clearly performing productive or direct labor, while the engine tender in the power plant is classed as performing unproductive or indirect labor. There is, however, much labor which is not so clearly defined. There is labor which is directly employed on output, but as it is employed for varying periods during the day on a large number of different jobs, each of which receives but a few minutes of time, it is impracticable to charge the time direct to each job. In a large establishment many cases of this kind can be found, for examples: A general helper or laborer employed in a machine shop or foundry who is called on to assist in many jobs during the day; a machine hand in a jobbing wood-working shop or pattern shop running several mcahines, may work on fifty jobs during the day; a man employed as a "move man" to move work from one machine to another, etc. With the shop organization that is almost universal it is impossible to correctly charge these men directly to the work on which they are engaged. Any attempt to do so will usually result in the large jobs getting nearly all the charges while the many small jobs get none. In many shops where some attention is given to shop-expense costs, and a more or less blind effort is made to reduce these expenses, the result will be that the time of such men is divided up by the foreman and charged direct to a few large jobs. It is far better to recognize the fact that this miscellaneous labor engaged directly on output cannot under present conditions be accurately charged to the output, and should be charged as indirect labor.

Frequently some of the supervisory force are engaged exclusively on one large job, and there are many arguments for charging such men direct to the job. In fact, I know of very few who advocate charging such men otherwise. For example, one sub-foreman has entire charge under the foremen of the erection of a large engine on the erecting slab; or an assistant foreman, himself with an assistant, has charge of retubing the boilers of a large ship. As these are exclusively engaged on the one job, at first thought it would seem proper to charge these direct to the work which has the benefit of their services, and this is the almost universal practice.

On the other hand, when a sub-foreman is engaged at the same time in the supervision of a number of jobs, his time is charged to the indirect order for supervision. Under this system the large jobs mentioned not only pay for their own supervision, but also help to pay for the supervision of other work where the supervisory force is charged to an expense order and pro-rated.

Another important objection to this method is that it impairs the accuracy of the records. There is an order number in the expense accounts for the shop supervision, and the manager desires each month to know exactly the cost of this supervision. By the usual method this cannot be told, and the comparisons made of the monthly expenditures are of little value, as one month all of the shop supervisory force is charged to the supervisory number, while the next month much of this cost may be hidden in the direct-labor costs. The supervisory force should never be charged direct to a job, but should always be charged to the supervisory number. This, however, does not apply to the supervisory force of an erection gang away from the plant, employed exclusively on one job. In this case the supervisory force is charged direct to the job and this job does not receive any part of the expense of shop supervision.

This not only refers to foremen, assistant foremen, gang bosses, etc., who are regularly classed as supervisory, but also to mechanics who are acting in a supervisory capacity and who are in the shop termed "straw bosses." This method increases the shop-expense charges, and on this account is objectionable to many, but if cost records are to be used to their full value, the system must be as rigid as possible, and the costs which are compared must always be for the same object or the same service.

Under these conditions it is necessary to define direct labor as the labor employed in the production of output, which it is practicable to charge direct to production orders, and does not include labor which, under the cost system used, is charged to supervision, miscellaneous labor, or other overhead orders.

Importance of Accuracy in Obtaining "Direct-labor Charges"

It is of the greatest importance to se-

cure accurate direct-labor charges. This is true not only on account of the importance of these charges in themselves, but in the great majority of shops the overhead charges are pro-rated to the different jobs on the basis of direct labor, and inaccuracies in these charges vitiate the accuracy of the distribution of the burden. In the case cited above, relative to charging certain supervision direct to production orders, not only do these orders pay for supervision of other work, but by increasing the direct-labor charge the order is made to pay for more than its share of all of the overhead charges. It is generally conceded that the best means of securing correct labor charges is by means of the individual service card, or time ticket, as it is sometimes called. A separate card is used for each job on which a man works. In the best organization these cards are made for the workman, and he has only to enter the time he starts and stops a job, and in some shops this is done by means of clocks. The total time charged to jobs must equal the payroll time of the employee. The type of service card and the method of using them will be described later.

Direct Material

Direct material has been defined as the material that enters in and forms a part of the product manufactured. This definition is not exact. Like direct labor there is some material that enters into the product that cannot be charged as direct material, but must be charged indirectly: Glue used in a joiner shop or pattern shop; a few nails or screws used on a repair job; a small amount of solder on sheet-metal work; a few cotter pins on a job in the machine shop; the red lead or litharge used in making joints; the material used with the oxy-acetylene welding plants; and many other similar items. On account of the difficulty of measuring the quantity used of some of this material and the small amounts used of other classes, it is impracticable to charge these direct, and they must be included in the indirect charges. Direct material must, therefore, be defined as the material which enters in the product that it is practicable to charge direct.

Much more care than is usually the case should be given to the custody of material and to the charges for material used. Many managers are very particular regarding the charges for labor, while they give but little attention to the charges for material. They insist that the total of the payroll must balance with the labor charged to the various orders, but they make no effort to balance the material charges. In many establishments much material is stored in the shop, and in some cases is free to all. When this is the case it is inevitable that material will be used and not charged to the job. Under these conditions there is also considerable waste, due to loss and pilfering. Scrap material which has been left over from a previous job is frequently used without charge or credit. Except in strictly manufacturing establishments it is rare that the material actually used will check with the charges made. There should be strict accountability for all material, and this cannot be accomplished without a rigid store-keeping system. To store all material, however, in a storehouse and send there every time minor miscellaneous material is required is a mistake. Not only will such a system cause much costly delay, but it will also force a foreman to acquire surreptitiously a small stock in the shop not on charge on the books.

In addition to the storehouse there should be established in each shop a well arranged stock room in which is kept a small stock of miscellaneous minor materials required to meet immediate demands of the shop. In the small shops this can be maintained in connection with the tool room. There should, however, be rigid accountability for this material. Regular stock cards should be maintained and the stock should be frequently inventoried. All material issued for a job which is not used should be returned to the store and the job credited. No material should be allowed in the shop unless it has been drawn for work under way. I have no doubt that eventually in all but small jobbing shops the bill of material required for every job that can be charged direct will be prepared in the office when the work is planned, and ordered from the store before the work is begun. This is now done in some establishments, but is by no means general. There is much that can be done to insure correct material charges, and if managers will give this subject one-tenth of the attention that they give to labor, large savings will be effected, and the cost records will be more accurate.

Indirect Cost

The indirect costs are generally called "expense charges," "expense burden," or "overhead expenses." These terms are unfortunate as they give the idea that they cover the cost of the administration and upkeep of the establishment, and nothing else. From the definitions of direct labor and direct material, it can be seen that both labor and material employed directly in product are included in the indirect costs, although not in anyway a part of the expenses of the establishment. In a foundry doing jobbing work, for example, it is an impossibility to accurately charge the helpers directly to the work, and these are usually charged to the indirect order for miscellaneous labor, yet they are engaged entirely on productive work. The sooner managers and others get away from the idea that the percentage of indirect costs to the direct labor is a measure of the efficiency of the establishment, the quicker will there be obtained accurate cost records, and what is still more important, the quicker shall we obtain increased efficiency. The measure of efficiency of an establishment is the total cost of the product, not a part of the cost, and the indirect charges are but a *part* of the costs.

Indirect costs may be defined as the element of the total factory cost of the product which it is not practicable to charge as either direct labor or direct material.

Total Factory Costs

The sum of the direct labor, direct material, and indirect cost is the total factory cost. To obtain the total cost there must be added to the factory cost the selling expense. The selling cost should be kept entirely separate from the factory cost in order that the efficiency of both the factory and the sales department may be accurately determined. Not only should the sales department be charged with the expense of advertising, salesmen, etc., but this department should bear its proper proportion of the general expenses, and should be charged with the work done by the estimating department for the benefit of sales.

Elements of the Indirect Costs.

The principal elements of the indirect costs are: Expenses of administration; miscellaneous labor and material which it is impracticable to charge direct to product; interest on money invested and rent; depreciation, both from age and use; upkeep of plant; taxes; insurance, fire, accident and casualty; heat, light and power.

Some of these expenses are well understood and require no explanation, but others are not understood in the average establishment and before accurate costs can be obtained all must be understood and their importance realized.

Depreciation

It cannot be considered strange that little is known in the average shop regarding depreciation when there is so much ignorance regarding this element of cost in quarters where one would expect to find knowledge. In many courts throughout the country it has been decided that depreciation is not an element of cost and should not be charged against income. Hatfield quotes a decision in a California court in which the judge decided that a charge of depreciation against income was "all wrong" and "not to be tolerated for a moment." Hatfield also states that some years ago the Supreme Court of the United States held regarding depreciation: "We are clearly of the opinion that it is not a

proper charge. Only such expenditures as are actually made can with any propriety be claimed as a deduction from earnings." On the other hand, the Statutes of Germany, France, Belgium, Switzerland and Austria require that depreciation must be charged before profits can be paid. The courts of England have also almost always held that depreciation must be considered, and this has been the ruling in many States in this country. The most important recent ruling is that of the Interstate Commerce Commission that an allowance must be made for the depreciation of the equipment of railroads.

All expert accountants are unanimous that depreciation must be charged to output and there is little doubt that any owner who will give the subject serious consideration will reach the same conclusion.

Perhaps one of the best examples of depreciation is that of a valuable patent, for which a large sum of money has been paid. It is known that this has but a certain number of years to run, and that each year its value becomes less. A certain proportion of the money paid for the patent must be written off each year and this must be charged to the product which is manufactured under the patent. This is elementary and is understood even by those who do not consider depreciation of buildings and plant equipment as a part of the cost. Oftentimes expensive plant equipment becomes obsolete and must be discarded in much less time than the life of a patent, and still many owners do not consider that the cost of such equipment should be charged to the work produced during the life of the machine.

There are two kinds of depreciation, one, the gradual wearing out due to age, which cannot be remedied by repair, and the other is due to machines or appliances becoming obsolete. In some classes of equipment the depreciation by wear is the more important, while in other classes used for work in which the process of manufacture is rapidly changing and in which an expensive machine may be out of date and discarded in a few years, the depreciation by obsolescence is the more important. Some expert accountants attempt to keep these two kinds of depreciation separated, but as both can only be approximately estimated there does not appear to be any advantages gained by this separation and it adds to the complication of the accounts.

How is Depreciation Determined?

Depreciation can only be determined by estimating the useful life of the building or machine and its scrap value at the end of the period, and spreading the difference between cost and scrap value over the period of life. The life of a building or equipment depends principally upon its character and use. Some buildings, for example a stone storehouse, depreciate very slowly—probably not more than 2 per cent. a year, while others depreciate very rapidly. A wooden blacksmith shop or foundry which is subject to smoke, heat, gases, etc., depreciates very rapidly. A building in which rapidly revolving shafting is employed, or machines operating with considerable shock, as a number of drop-forge hammers, also depreciates rapidly and for such a yearly depreciation of from 4 per cent. to 8 per cent. should be allowed.

Machinery depreciates more rapidly than buildings and some classes much more than others. This is true of depreciation by use, but greater differences are found in different lines of manufacture due to advances in the methods of manufacture. In some lines the changes in methods are not radical and are comparatively few and the life of a heavy machine tool can conservatively be considered as 15 to 20 years. In other lines there are radical changes due to new inventions, and these may be frequent and it is not safe to consider the life of the machine as greater than five years.

Various estimates of experts are available regarding the rates of depreciation; perhaps those given by Dicksee and Tiffany serve as the best rough guide, but the average rates recommended by the commission of the National Machine Tool Builders' Association are, for the manufacturer, more conservative. These are as follows: 10 per cent. on machinery, 5 per cent. on frame buildings, and 3 per cent. on brick buildings. These rates are for favorable conditions, and apply to the total original value and not to a decreasing value. However, no rates should be accepted and used without full investigation of the conditions of the equipment under consideration. The Interstate Commerce Commission has refused to promulgate standard rates of depreciation, stating that "Conditions under which equipment is used vary so greatly that no uniform rate of depreciation for all roads could reasonably be determined. The proper rate will, of course, vary inversely with the life of the property to which it pertains, and its determination must take into consideration whatever affects the life of the property."

Each case must be considered on its merits, and the estimates should be made by one of experience and judgment who knows all the conditions; but it is wise to remember that it is far better to err by over-estimating than by under-estimating the depreciation.

Determination of the Depreciation to be Charged Off Each Year

There are numerous methods offered by accountants for charging off the depreciation yearly. It is considered that from the standpoint of the manager or engineer only two need be presented. The first and simplest, and the one most commonly used, is to divide the difference between the actual first cost and the scrap value by the number of years it is estimated the machine or building will be used, and the quotient gives the yearly amount which must be charged to the cost of the product. The second method is theoretically at least more attractive. The cost charged to the product on account of a machine or building is not only depreciation, but also repairs, and it is desirable that the sum of these two for each year should be fairly uniform. When a building or machine is new the repair cost will be small, and it will increase with increasing age. Therefore to keep the sum of depreciation and repairs fairly constant for each year a high depreciation should be charged when the plant is new, and should be decreased each year. This method of charging depreciation is also in accordance with the actual value of a machine or building at a forced sale, as there is no doubt that the reduction in selling price will be greater after the first year of use than the reduction in value from the ninth to the tenth year. Moreover, a new machine is probably competing with old machines, and later, as it grows old, is in turn competing with new machines; a machine is, therefore, better able to stand the higher charges for depreciation when new; and with the low rate when old is better able to compete with new machines. There are numerous ways of computing the decreasing rate. The method given by Cole is simple and satisfactory. He divides the difference between first cost and scrap value by the sum of all the numbers representing the years of life, and depreciates each year a fraction comprising the number of years to run as a numerator and the sum of the year numbers as a denominator; for example, if the lifetime is five years, add, 5, 4, 3, 2 and 1, getting 15, and in the first year write off 5/15, in the second year 4/15 and in the last year 1/15. Applied to a machine costing $200 to last five years and with a scrap value of $20, this works out as follows:

$200 — $20 = $180, shrinkage.

Denominator, $5 + 4 + 3 + 2 + 1 = 15$;
$\$180 \div 15 = \$12$.

Year.	Depreciation. Fraction.	Depreciation.	Value.
0	.....	.....	$200.00
1	5/15 of $180	$60	140.00
2	4/15	48	92.00
3	3/15	36	56.00
4	2/15	24	32.00
5	1/15	12	20.00

The Usual Method of Estimating and Apportioning Depreciation is Unsatisfactory

In many establishments where depreciation is considered the manner of estimating and apportioning the amounts is almost entirely guesswork. Usually the estimated value of the buildings is taken as a whole and a total yearly depreciation figure fixed. The machine tools and other plant equipment are similarly treated as a whole. The total depreciation is then treated as a general expense and is applied either as a percentage of direct labor or on the basis of hours of productive labor. There may be great variation in the depreciation of the various buildings of the plant, and this is also true of the plant equipment. It is impossible to even approximate to an average rate of depreciation under these conditions. In every plant there should be a complete inventory of the plant equipment and buildings. This inventory can best be kept on cards and the condensed history of every building and every machine should be given on these cards. For each building and each class of tools or equipment the life should be estimated and the yearly depreciation determined and this should be recorded on the inventory cards; from these total depreciation can then be obtained.

The usual method of apportioning depreciation is also unsatisfactory. In a large plant the depreciation amounts to a considerable sum, and by charging this into general expense it is distributed as an average and some shops or departments pay a much higher rate than should be charged, while others pay lower. For example, there is comparatively little equipment in a sail loft, a rigging loft, a paint shop, a shipwright's shop, or for a laborers' force, while a large number of men are employed. By charging depreciation to general expense the work in the shops mentioned pay for a large proportion of the depreciation of expensive equipment in the machine shop, electrical shop, sheet-metal shop, joiner shop, etc.

It requires no additional work to determine the depreciation for each shop or department and but little additional clerical work to apportion this each month to the department or shop to which it belongs. The shop depreciation then becomes an element of the shop expense and only such depreciation as cannot be charged to the shops goes to the general expense. With the improvements in methods of shop management depreciation, together with other fixed charges, will be further divided and apportioned to both machine-tool times and labor, but such methods are today not practicable.

The disposition of depreciation after it has been charged to product comes within the province of the accountant and not the cost keeper, but briefly it may be stated that the amount charged to product should be credited to the real estate and plant equipment accounts and debited to the depreciation account, and should each month be closed into profit and loss. If the establishment is operating at a profit there is available from depreciation a fund, the amount of which just equals the shrinkage in the value of the physical assets of the company due to depreciation. This can be employed to purchase new plant equipment or as a sinking fund, but must not be considered as an additional asset.

Taxes and Insurance

These expenses require little explanation. The general method of distributing these by charging them to general expense is open to the same objection, stated above, regarding depreciation. They should be apportioned to the shops or departments in accordance with the value and the risks and should be charged to the shop expense, except that portion which cannot be charged to shops and is for the benefit of the whole plant, which should be charged to general expense. Special insurance should be charged direct to the work it covers. An example of this kind is the insurance of a ship building at a shipyard, or if a special product, on account of its nature, temporarily increases the insurance rates on the whole plant or a portion of it. In these cases the additional insurance paid should not be charged to the expense accounts, but should be charged direct to the product which causes the increase in the regular rates.

Upkeep of Plant

No question arises regarding ordinary repairs, but there is sometimes a tendency to charge minor additions and changes and also repairs which are in the nature of renewals to the capital account, and great care should be exercised in making charges of this nature to this account. No minor changes or additions should be so charged, and no repairs in the nature of renewals should be charged unless it be clear that they actually add to the market value of the plant. In no case should additions or part renewals be taken up direct in the capital account, but should be carried in separate accounts and so shown on the balance sheet, so that the merit of these transactions may be judged. In all ordinary cases the cost of upkeep should be charged to the proper expense account.

Interest and Rent

There is much discussion as to whether or not interest should be charged to the product. If the entire plant is rented no one questions that the rent paid should be charged to the cost of production, but when the plant is owned by the company operating it many consider that interest and rent should not be charged. If it is correct to charge rent in the first case, there should be no question that it is a proper charge in the second. The interest on the investment must be met and this is chargeable whether the concern owns the property or not, for whether return is made to landlords, lenders of capital or to stockholders the output must produce some means of meeting it. Professor Cole in his treatise on accounting puts this very clearly as follows:

"Rent in the ordinary use of the word is composed of two elements: First, payment for exceptional advantages accruing to the owner of land or buildings because of location or other *natural* qualities—as exceptional shipping facilities or low power-cost; second, interest on the improvements made on the land, such as buildings. In the true economic sense, rent is only that part of the payment which is due to the exceptional facilities, as low power-cost. Obviously rent arising from such advantages is in one sense not cost at all, but a measure of gain—it measures the saving by having the use of this special facility. Even though such economic rent is paid to another, it comes back in the saving. It is an outgo, but it is offset by a special income—or, what is the same thing, a reduced expense elsewhere. This has led to the theory that, at least for the manufacturing concern owning the land and buildings which it uses, rent need not be included in the schedules of cost.

"The reply to this lies in the answer to the question, What is the purpose of keeping manufacturing accounts? Unless the accounting shows not only a basis of charges for manufactured goods, but also what are the gains from the conduct of business, it is not worthy of its name. If the concern pays rent, clearly the rent is a cost—as much as the payment for wages: in both cases an outgo is suffered in order than a return may be secured. If the concern is the owner of the property that it uses, two facts require that rent be charged as a cost. First, if the property is valuable enough to yield economic rent (i.e., more than interest on the improvements on the land), it is so because it confers some advantage in lower costs—as cheap power or low freights. If, then, rent is excluded from costs and the cost book shows only actual cost paid to outsiders by the business, prices based on the cost book give to the customer all the advantages of the cheap power or the low freight. Such prices are not normal and can never long continue. The only way to show the facts is to show that the cheapness of power or of freight is abnormal, and this can be done by entering rent as one of the costs. Second, the concern is in this case not merely engaged in manufacturing; it is a landholder, and as such it receives a land-

holder's revenue as distinguished from a manufacturer's revenue. An important purpose of accounting is to show different kinds or sources of revenue."

In practice it is not necessary to separate rent proper from interest, and the two should be carried together as a percentage of the total investment.

Interest should be distributed to the product in the same manner as has been described for taxes, insurance, and depreciation. The amount charged to the product should be carried to the reserve interest account, and each month should be closed into profit and loss.

An Investigation of Bearing Metals

By H. B. McDermid

Actual conditions under which tests were made of seven different bearing metal mixtures of tin-lead-antimony and copper-tin-antimony alloys.

The size and shape of the bearings and the testing machine. Results of test are tabulated and charted. Results obtained from some of these alloys in actual work are also given.

The choosing of his materials of construction, in the face of modern competition, often becomes a serious problem to the manufacturer of machinery, and is worthy of serious study.

The use of some 400 tons of babbitt metals per annum, by a company engaged in the manufacture of heavy power-plant prime movers, was deemed to be a sufficient reason to justify a thorough investigation of the physical properties of those metals. In consequence, a series of friction tests were carried on, of sufficient length to quite completely determine the running characteristics of a number of different mixtures.

The object of the work done was largely to determine whether or not the cost of making bearings could be reduced without lowering the factor of safety to a dangerous point.

The cost of materials for the different mixtures varied from about 7 to 33 cents per pound. In view of this fact, some of the results obtained were decidedly interesting. There are many places in modern machine construction where the designs can be made such as will permit of low unit pressures on bearing surfaces, so that a cheaper bearing metal can be safely introduced.

Cheaper Construction

In many instances, pressures now used will permit of less costly construction, especially as, in some instances, the higher-priced metals do not show as high-grade performance as some mixtures whose costs do not exceed 40 per cent. of their more costly competitors. This is markedly true of bearings running under good lubricating conditions, with the pressure constant and always in one direction, as in many forms of motor bearings, generators, steam turbines, etc.

An example of this is a 6500-kilowatt dynamo running in two bearings 14x48 inches each, where the unit pressure due to dead load is but 70 pounds per square inch, and where, being direct connected to an hydraulic turbine, the pressure is always steady and in one direction. This machine was furnished with a supposedly high-grade babbitt at a cost of some 25 cents per pound, when test results proved an 8-cent mixture to be superior in every case under those conditions, and showed it to be fully capable of carrying the load at all times, even when the magnetic pull due to an unbalanced air gap was taken into consideration.

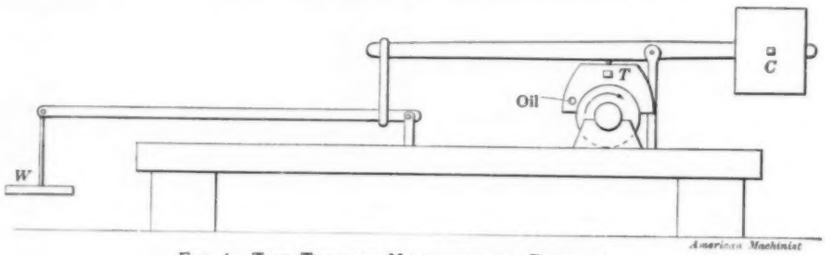


Fig. 1. The Testing Machine for Bearings

While the difference in cost of this item of bearing metals is but a small percentage of the total cost of a machine, the difference on several hundred pounds of metal would pay well for the services of a high-class man, whose business would be to study the needs of each service, and then to specify proper material for each special case as it arose.

Conditions of Tests

The tests were run, for the most part, upon a homemade machine, so arranged that any desirable load could be placed upon the test piece, which was made in the form of an upper half box, covering a full half of a 7-inch journal. The journal was carried in side bearings of ample area to insure their safely carrying all loads imposed upon them. The surface speed at the test piece was 480 feet per minute and at the side bearings 220 feet per minute.

No appliance was provided for the direct measurement of the friction developed, so that the rise in temperature was taken as the only indication of the friction of the rubbing surfaces, and with cool running side bearings so that no outside error could creep in to any extent. This method was found to be amply accurate and satisfactory for the comparative tests desired.

The Test Machine and Bearings

The general arrangement of the machine is shown in Fig. 1, where *C* is an adjustable counterweight used to balance the system of levers shown, and *W* is a weight pan used for loading the test piece *T*. The ratio of the force exerted at *W* to that at *T* was 1 to 70. It was thus comparatively easy to get relatively high unit pressures on the test piece,

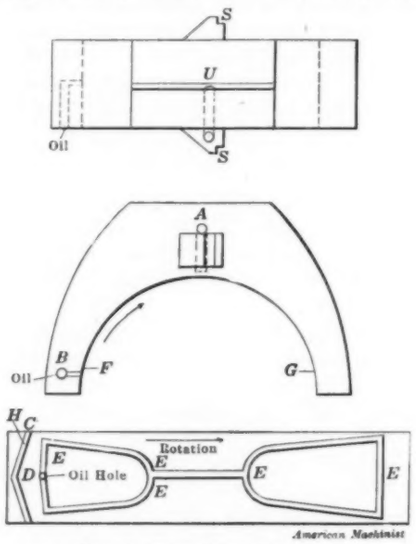


Fig. 2. The Test Bearing

which measured 7 inches in diameter and 2 inches long.

A side elevation and plan, and a developed plan of the test bearings is shown in Fig. 2. Here *A* indicates a thermometer well, drilled diagonally down through the stop piece *S* which is on each side. During actual work, this stop piece rests against the frame of the machine in such

a manner as to prevent rotation about the shaft. To render the sketch clearer, this portion of the frame is not shown in Fig. 1. The thermometer well was drilled so the bulb of the instrument would rest at a point ½ inch above the bearing surface of the babbitt and in the middle of the test piece, as measured along the axis of the shaft. *B* is the place for introducing the lubricating oil, which was fed from a drop-feed oil cup during the final tests.

In the developed plan, a system of air and oil grooves is shown. These were the same for each specimen, and were cut so as to finish 3/16 inch half round in section. The air groove was found necessary in order to carry off air that was drawn in by the rapidly rotating shaft, which otherwise was forced out at *B* in quantities great enough to render uncertain if not absolutely destroy the lubricating of the piece. In order to have it in proper working condition the edges of this groove must tightly fit the journal at the inside edge *D* and be loose and free at the outer edge *H*. The mixture of air and oil that adheres to the shaft is then scraped off by edge *D* and deflected to the sides of the piece, thereby insuring undisturbed lubrication of the rubbing parts. To insure thorough spreading of the entering oil, the oil channels are well relieved at the sides *E*.

possible, and yet run widely different final tests.

To this end, then, the babbitt was carefully melted, in clean ladles, so no dross nor undue burning or overheating might form gritty or abrasive spots or surfaces that might cause friction and heating; the metal was carefully anchored in the shells so that it might always have solid, positive, uniform backing to transmit the heavy pressures of the system of loading levers with no springing, breaking, or pinching; it was closely bored to fit the journal, and machined to exact dimensions; and the journal was ground straight and cylindrical, so that for each piece tested, the conditions were made as nearly uniform as good mechanical skill could make them.

The test piece was fitted to the machine by placing it upon the journal and fitting the stops *S S*, until both bore equally upon their stops on the frame of the machine within the limit of 1/1000 of an inch, thus eliminating the possibility of any sort of side twist being introduced. The casting at *U* was so beveled that the load perforce had to bear vertically downward and thus eliminate all pressures not in a vertical plane passing through the center of the bearing, normal to the axis of the test journal.

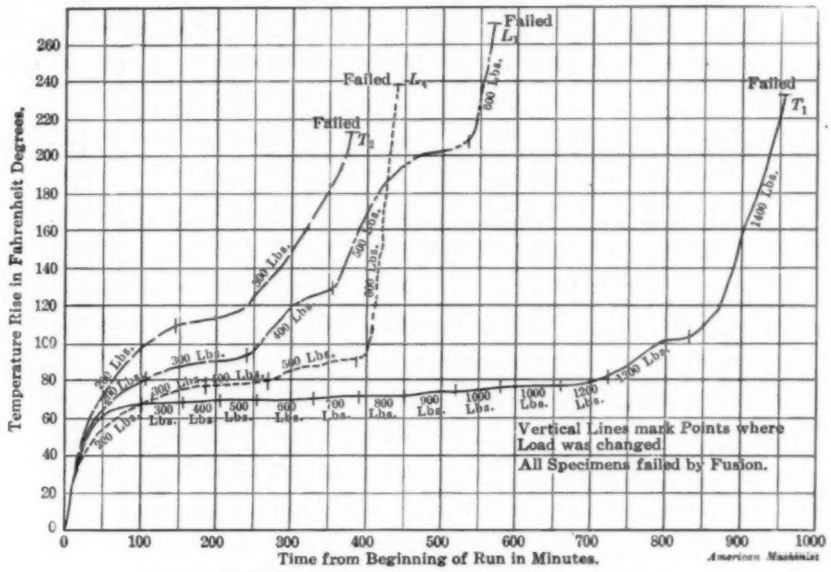


FIG. 3. AVERAGE TEST OF THE FOUR HIGHEST MIXTURES

By these means it was believed that reasonable accuracy in conditions had been obtained and correspondingly dependable results were secured.

PRECAUTIONS TAKEN

Every precaution possible was taken to insure uniform working conditions for each test piece, so that the test might be dependably accurate, at least for comparative results. It was ascertained that after minute and careful inspection two test pieces might appear exactly alike, might be of the same material, have apparently identical smoothness of glazed surface, be treated as closely alike as

PREPARING THE BEARINGS

The bearing was next "spotted in" upon the slowly revolving shaft and scraped to as close a fit as possible, the oil and air grooves were then cut and finished and the journal placed in an oil bath and run at full speed. The bearing was placed under very light loads at first and this gradually increased, as the thermometer record showed it could stand it, until the bearing possessed a perfect glazed contact with the journal from *F* to *G*, and would run at a cool uniform temperature under heavy loads.

This latter point was very important as two bearings may apparently have an equally good fit and glaze, and yet, even though of the same material, one will coolly stand up under a load that would shortly ruin the other, due to minute differences which even the closest inspection must fail to detect, and which cannot be detected except by a running test under identical conditions.

This preliminary "running in" occupied from ten to thirty hours, according to the material tested and to the care with which the preliminary and subsequent fitting had been done. During this preparatory stage the temperature was never allowed to rise above 220 degrees Fahrenheit, so the oil would not carbonize upon the rubbing surfaces under any conditions and so permanently injure them.

Name.	Copper, Percentage.	Tin, Percentage.	Lead, Percentage.	Antimony, Percentage.	Bismuth, Percentage.
L_1	..	15	75	10	...
L_2	..	9	90	1	...
L_3	..	5	80	14.5	0.5
L_4	..	5	85	9.5	0.5
T_1	5	85	..	10	...
T_2	4	61	25	10	...
T_3	6	83	..	11	...

TABLE 1. CHEMICAL ANALYSES OF ALL MIXTURES.

The run was kept up as continuously as convenient with each specimen until it would stand from 600 to 1000 pounds per square inch under oil bath conditions and still run fairly cool. The machine was then allowed to cool down over night to practically the temperature of the room, and without anything occurring that could disturb the accuracy or perfection of the fit of the rubbing surfaces of either the journal or test piece, the final test was begun.

FINAL TESTS

The following rules were closely adhered to in conducting the final tests after the specimens were fully prepared:

1. All tests to be started with the whole machine and testing system practically at the temperature of the room.
2. The oil to be a standard high-grade engine oil, with a sufficient supply on hand to permit of the whole series of tests being run with the same lubricant.
3. A standard new oil cup to be used and the oil fed upon the bearing at 45 drops per minute; the rate of feed being checked every ten minutes.
4. Each bearing to be loaded at the start, with a pressure of 200 pounds per square inch. Readings of room and bearing temperatures to be taken every five

minutes, until the temperature of the bearing became constant within two degrees Fahrenheit for three-quarters of an hour. The load then to be increased to 300 pounds per square inch with temperature readings taken as before. The load then to be increased to 400 pounds, and so on until failure occurred by fusion of the mixture under test.

5. All tests must be judged by the same thermometers. The thermometer well must be filled with oil at starting so the heat from the bearing will be readily and accurately transmitted to the bulb of the instrument.

6. Care must be taken to have all parts of the machine in proper adjustment and kept so. All other conditions must be kept as nearly standard as possible, so the working will be thoroughly reliable as a comparative test.

Duplicate Tests

After the test had been run to the finish by "failure," a process that necessarily had to be completed without interruption of any kind, and which lasted from 3 to 15 hours with varying grades of metals, the machine was dismantled, and the journal taken out and reground until it was again perfectly true, straight and cylindrical. A second bearing was then put through its preliminary preparation and its final test run under the same conditions as the first had been, as nearly as care and skill could reproduce them.

Each mixture, as it was physically tested, was also chemically analyzed so that the effect of the various ingredients could be noted and recorded. Its price was also taken into account, so that a comparison of worth per dollar of cost could be made. In every case several duplicate tests were run in order that checks on each of the earlier tests could be had, with each mixture and in every case, and the average of several tests is used in compiling the following data:

Four mixtures containing high percentages of lead were used, and three containing high tin percentages. Table 1 gives the chemical analysis of all the mixtures used. The capitals *L* and *T* indicate the major portion of each alloy, as being either lead or tin.

Details of Tests

The chart, Fig. 3, of the final test performance is plotted with time as abscissas and differences between room and bearing temperatures as ordinates. The first section represents the record under 200 pounds load, the second that of 300 pounds load, etc.; the point where the load was changed being indicated by a short vertical line. The sudden vertical break in the last section indicates the point where lubrication failed and the oil grooves smeared over, resulting in the complete and rapid destruction of the piece under test. To avoid confusion and undue crowding only the four most representative records are plotted.

Table 2 summarizes the increases in temperature for each load, the duration of run under each load and gives an approximate price per pound of each mixture.

The behavior of these bearings under the preliminary tests as well as in the final tests was very interesting. For instance, the high-lead mixtures, which, of course, would not stand peening into the shell, gave considerable trouble at first in obtaining a good support or backing for the bearing metal to the shell. This was because of their high shrinkage coefficient. The high tin alloys which do not shrink so much, in case of the anchors not being sufficient, could be peened solidly into the shell, and so eliminate troubles of this sort.

The high-lead bearings being the softer, were brought to a good running fit easier, but they would not recover when neglected or abused, with anywhere near the facility of the high tin mixtures.

The Mixture to Choose

Those mixtures showing a high content of antimony, as *L*3, were naturally hard and took a considerable length of time to come to their running fit. They were, therefore, somewhat less desirable than the softer materials, since any of the mixtures, well lubricated, will wear well enough for ordinary machine work, and the important quality of a babbitt mixture is its ability to adapt itself quickly to a deformed or roughened journal without undue heating or cutting.

The tenacity of the tin and copper in mixture T_1, combined with the ductility, render it easily the best of the group, but the high-lead mixture *L*4 seems the best of the combinations here listed, for ordinary work.

The high cost of mixture T_1 puts it entirely out of the question, except where special service requiring high quality to stand rough hard usage is demanded, or where the type of service makes uninterrupted running so important as to overshadow the item of first cost. In all other cases, of ordinary service, the tests show such an alloy as *L*4 to be very satisfactory, especially where, under reasonable conditions, a bearing may be expected to have good ordinary care, and a steady load in one direction, without violent and sudden reversals of pressures.

Even under such conditions, some practical master mechanics of long and varied experience in heavy rolling-mill work, have assured me that they would just as soon have a mixture like *L*4 placed in the bearings of a number of 3000-kilowatt gas-engine units, then under discussion, as to use the mixture sim-

Name.	Cost per lb. in Cents.	200 lb.		300 lb.		400 lb.		500 lb.		600 lb.		700 lb.		800 lb.		900 lb.		1000 lb.		1100 lb.		1200 lb.		1300 lb.		1400 lb.		1500 lb.	
		Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.	Time Min.	Temp. Rise.
L_1	9.7	105	° F. 81	135	° F. 11	115	° F. 37	180	° F. 73	30	° F. 62	Failed at 600 lb. Total Temp. Rise 211°																	
L_2	7.4	100	79	75	5	155	9	160	130	Failed at 500 lb. Total Temp. Rise 231°																			
L_3	7.6	90	64	105	12	95	8	120	14	40	152																		
L_4	7.3	115	69	70	8	85	3	115	11	55	145																		
*T_1	32.5	100	67	55	3	50	0	50	0	75	0																		
T_2	24.7	145	109	235	102	Failed at 300 lb. Total Temp. Rise 237°																							
T_3	32	170	106	90	12	105	10	70	3	80	6	50	5	50	1	45	3	25	90	Failed at 1000 lb. Total Temp. Rise 237°									

*Failed at 1400 lb. Total Temp. Rise 231°.

TABLE 2. AVERAGE TESTS OF ALL THE DIFFERENT MIXTURES.

ilar to *T2*, which was furnished. They also assured me they had cured obstinate cases of hot bearings, where several varieties of tin mixtures had failed, by replacing them with a high-lead mixture. This ran very cooly from its first start and thereafter gave no further trouble.

Summary

It is not my purpose to advocate an undue cheapening of the materials of machine construction, especially in so important a place to the life and usefulness of a machine as its bearing metals; nor is it my intention to bank too strongly on the results of the tests just cited as being a safe guide for the choice of bearing metals to be used under all conditions. No one realizes better than I that a change of bearing-metal conditions often brings about decided variations in the performance of the mixture in question. Neither is it my purpose to enter into any long or intricate discussion of the problems of bearing design, but in these days when forced and ample, even excessive, lubrication is daily becoming more popular, it would seem as if the conditions such as were used in the test could be closely approximated in most cases and thus the cheaper bearing be safely introduced.

If the experience of master mechanics of some of the largest steel plants is such as to find the high-lead bearing acceptable for the rough usage of heavy rolling-mill and the heaviest gas-engine practice known, it would seem at least worthy of a fair trial.

It is my own experience that a mixture similar to *T2* has stood the test for years of generator service at from 60 to 90 pounds dead-load unit pressures, with the possibility of a magnetic pull, due to an unbalanced air gap, doubling that pressure. It is also used with success in engine main bearings where the pressures withstood vary from 200 to 250 pounds per square inch and in crank-pin boxes where the momentary pressures at the point of admission of steam to the cylinder reach a maximum of 1400 pounds per square inch.

If a mixture of so poor a test record as recorded above, has so good a record in years of actual service under widely varying conditions, should not a mixture of a highly superior test record, with an initial cost of less than one-third of that of its rival, be given at least a fair opportunity to make a record by which it must stand or fall? It would seem so, and I will venture to predict that such will quite generally be the case in the near future and that under the policy of ample lubrication now gaining ground daily in power-plant service, the results will amply justify the experiment.

Unusual Slotting Job on the Planer

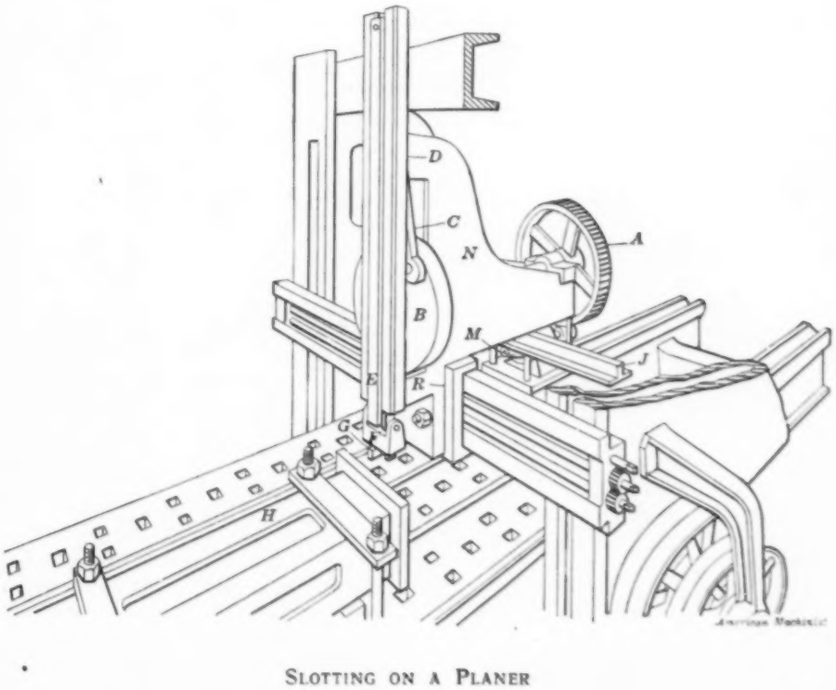
In the accompanying illustration is seen a rather unusual "stunt" which was performed in the shops of Riehle Brothers Testing Machine Company, of Philadelphia. In the making of an unusually large column-testing machine recently, it was found a serious matter to face off the ends of the sections forming the box columns of the machine. These sections, bpart of one of which is shown at *H*, were 12 feet long, and could not be accommodated on any planer available, nor was a suitable slotter at hand. It was decided, therefore, that the easiest way out of the dilemma was to improvise a slotting device for application to one of their planers.

Referring to the illustration, *N* is one side of a double cast-iron frame to which the guide *D* is attached. In this guide the ram *E* is caused to rise and fall by means of the crank disk *B* and the connecting rod *C*, as in any slotting machine. The gear wheel *A* is on the end of the shaft carrying *B* and is driven by a pinion on electric motor *M*, which is hung in a cradle underneath *N*. It will thus be seen that the drive is one of constant speed, there being no quick-return motion.

Casting *N* is bolted to the planer saddle *R*, the swivel plate having been removed. *F* is a tool block which, as will be seen, is pivoted to the bottom of *E* by means of a pin parallel with the cross rail of the planer. *G* is the slotter tool, which is held in an ordinary yoke underneath *F*. Suitable springs between *F* and *E* keep the tool *G* up in position for the cutting stroke, so that no breaking takes place at the start of the cut. Adjustable set screws in *F* butt against the bottom end of *E* so as to take the thrust of the tool while cutting. Cross rail *J* is fastened between the two housings of the planer, and acts as a steady rest to the back, overhanging portion of *N*, taking the weight of this end.

In operation, the motor drives the slotting ram, while the slide carrying the whole slotting apparatus is traversed across the rail of the planer by operating the hand feed in the rail. When one of the flanges of *H* has been faced off, the tool block *F* is removed and turned around, the planer table is run through without disturbing the blocking and location of *H* upon the table, and the opposite flange, on the other end of *H* is brought underneath the cross rail, so that the reversed tool may face this flange parallel to the first one. In this way parallelism of the two flange faces is insured.

Of course, it will be understood that in the illustration a portion of the right-hand housing of the planer has been broken away so as to show the working parts of the slotting head. The cutting stroke is 24 inches and the maximum cutting speed 30 feet per minute.



Slotting on a Planer

Producer and Water Gas for Furnaces

By L. B. Lent

Data concerning water gas made in a Loomis-Pettibone apparatus similar to that recently installed in the new shops of the Lackawanna Railroad at Scranton, Pa. The composition, method of producing, cost and efficiency of the gas and its applications. Also a detailed description of the apparatus.

It is hardly necessary to state that the ideal fuel for all purposes is some form of combustible gas, but this fact furnishes the principal reason for gasifying solid fuels before burning them.

In the working of metals, the use of gas is confined almost entirely to its combustion in some form of furnace or forge. In these uses, the principal advantages may be said to be: High temperatures, quick control of temperatures, the maintenance of uniform temperatures and high furnace efficiency. If the advantages were compared to those incident to the use of coal or oil as fuel, a much greater number might be given, but some would only be "advantages" under certain conditions.

It is only by a knowledge of the physical and chemical properties of gaseous fuels; of how they are made (if not natural gas), and how used; and something of the commercial aspects of both the manufacture and use, that one is able to make a comparison of its advantages.

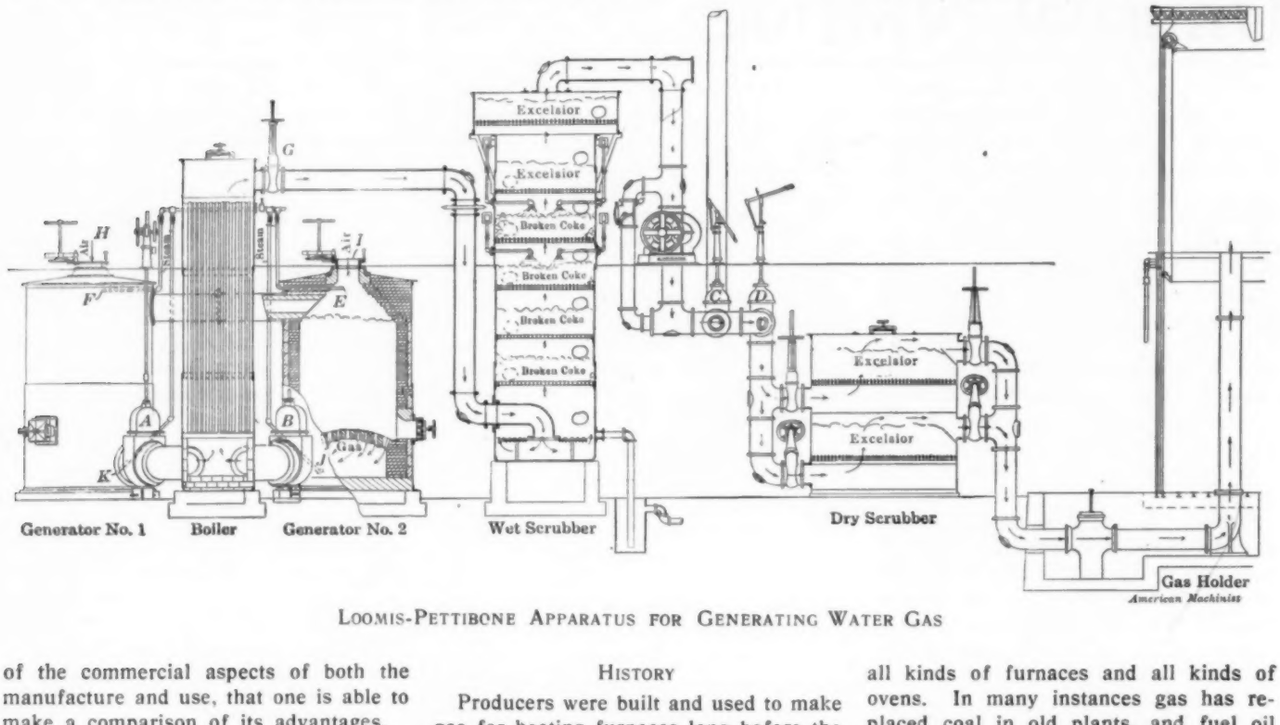
Purpose of Article

It is the purpose of this article to give the reader the information on which to base a calculation as to whether it will be profitable or not to install and use gas made from solid fuel.

It certainly has been profitable and advantageous for many firms in this country and abroad, for the gas plants now in operation aggregate many million cu.ft. in rated capacity.

It should be stated that this article is not intended to apply to the manufacture and use of what is commonly known as city, or ordinary illuminating gas, nor does it apply to the raw, hot, uncleaned gas used in steel mills, cement kilns, etc.

It deals more specifically with what are commercially known as producer and water gas, both of which are made in the same producer apparatus and are the artificial gases used most in purely metal-working plants.



Loomis-Pettibone Apparatus for Generating Water Gas

History

Producers were built and used to make gas for heating furnaces long before the gas engine was a commercial success, although recently producers have been used largely for producing power gas for consumption in gas engines.

As long ago as 1839, Bischof, of Magdesprung, in the Harz, introduced an internally fired producer and burned the gas in furnaces. The greatest impetus to the early development came from the invention, in 1857, by F. Siemens, of a combined gas producer and regenerative furnace.

The principle of regeneration, embodied in his invention, is that in common use today. The increase in furnace efficiency and the possible attainment of higher temperatures made desirable the use of even such a lean gas as the producer made.

The use of gas made another acceleration when Lowe, in 1847, brought out his apparatus for making what is known as water gas. The calorific value of this gas is much greater than that of ordinary producer gas, and the flame temperature is much greater, so that the use of this gas is possible in many operations in which producer gas is not.

Utility

It has been learned only in the last few years that higher flame temperatures are possible by compressing the gas and the air necessary for its combustion, but this is not always desirable, as we shall see. Water gas and a mixture of water gas and producer gas are now used very extensively for a great variety of purposes, such as in all kinds of forge work, all kinds of furnaces and all kinds of ovens. In many instances gas has replaced coal in old plants, and fuel oil in others.

The exact chemical reactions that take place in any gas producer are difficult to determine, but analysis of the gas made and analyses of gas drawn from different parts of the fuel bed give a sufficiently exact idea to guide the designer and operator.

The Producer

The subject of gas generation in various forms of producers using various kinds of fuels is one that requires a volume of quite formidable dimensions for its proper treatment. It is considered sufficient for our purpose to describe briefly the operation of one type of pro-

ducer which has been widely used for many years, first for furnace work and afterward for making power gas. This is the Loomis-Pettibone producer and is known as the down-draft type. Such a producer equipment is shown in the accompanying line cut. If the chemical and physical properties are known and something of the process and manufacture, the application of both producer and water gas in metal-working operations should be more easily understood.

No.	CO_2	C_2H_4	O_2	CO	CH_4	H_2	N_2	B.t.u.	Remarks.
1	3.6	0.3	0.2	26.9	1.1	9.4	58.8	132.1	Boston L. bituminous coal.
2	4.1	0.1	0.1	24.8	1.0	8.5	61.4	118.5	Cudahy bituminous top steam.
3	1.2	...	0.2	31.4	1.9	9.3	56.0	153.3	Tecolotes charcoal.
4	2.7	...	0.2	27.3	0.8	5.1	63.9	113.6	Boston L. air gas.
5	5.5	...	0.2	22.3	0.7	11.3	61.0	116.7	Cudahy anthracite top steam.
6	10.6	0.4	0.3	14.1	2.6	13.8	58.2	121.3	Dakota lignite.
7	14.4	0.2	0.4	15.5	2.3	19.3	47.9	137.6	Nacozari wood.
				Water Gas.					
8	5.3	0.4	0.3	32.6	2.9	42.1	16.4	272.5	Bituminous coal.
9	3.5	0.5	0.2	42.4	2.7	44.3	6.4	314.8	Anthracite coal.
				Half Producer and Half Water Gas.					
10	3.6	0.3	0.2	34.7	1.8	26.8	32.6	223.4	Bituminous coal.

TABLE 1. TYPICAL GASES MADE IN LOOMIS PETTIBONE GENERATORS: ENGINE GASES

Chemical Reaction

Producer gas is formed usually by the partial combustion of solid fuels. This is brought about by making the fuel bed of considerable thickness. When carbon is completely burned, the product of combustion is carbon dioxide (CO_2). Were this gas to be passed through an incandescent bed of carbon it would pick up some of the carbon and become carbon monoxide (CO), which is a combustible gas.

In carbonaceous fuels, such as all coal, this is almost precisely what happens to the carbon constituent of the coal. One of the constituents of producer gas is carbon monoxide and as the oxygen necessary for the combustion of the coal is supplied from the air, the nitrogen in the air is set free. This does not enter into combination during the processes, but passes through and becomes an inert and dilutent gas of the ultimate product, producer gas.

Capacity in Cubic Feet per Day.	Water for Steam, Gallons.	Water for Scrubber, Gallons.	Total Water, Gallons.
18.84	100	759	859
42.48	227	1,710	1,937
44.76	239	1,802	2,041
78.60	419	3,165	3,584
132.90	709	5,360	6,069
194.70	1,038	7,850	8,888
295.00	1,573	11,890	13,463
389.00	2,075	15,670	17,745

TABLE 2. WATER USED IN SINGLE GENERATOR PLANT PER DAY OF TEN HOURS.

Volatile Matter

Since both anthracite and bituminous coals contain volatile matter as well as fixed carbon, the gas made from these fuels contains other compounds, principally of carbon and hydrogen, such as marsh gas, CH_4, ethylene, C_2H_2, and some others.

Gas made from bituminous coal in an up-draft producer contains a considerable amount of condensible tarry vapors, depending in amount on the quality of the coal, and where this gas is used in small pipes or burners, this tarry matter must be washed out of the gas. The heat of the fire distils these vapors out of the freshly-charged fuel, but where they can be drawn through an incandescent fuel bed, they become converted into fixed gases. This occurs in the producer shown.

Effect of Steam

When steam is forced through an incandescent bed of coal, the heat is sufficient to dissociate it into its elements of oxygen and hydrogen. The oxygen set free combines with the carbon in the coal, forming carbon monoxide, CO, and the hydrogen is set free. These two gases, CO and H, theoretically form equal volumes of what is known as "water gas."

The actual composition of water gas made from both anthracite and bituminous coals is shown in table 1.

The process of making water gas is always an intermittent one, because the steam blast through the fire always tends to quench it and so necessitates the repeated blowing up of the fire with air to again bring the temperature up to the required point.

However, a limited amount of steam may be admitted continuously without lowering the temperature below the gasification point, and this is usually desirable in making producer gas only, for it provides a considerable amount of free hydrogen, which increases the calorific power of the gas.

The Producer Plant

All of these actions and reactions may be better understood from a description of the commercial operation of the plant shown in the line cut.

Plant Capacity, Cubic Feet Gas per Hour.	Price of Coal per Ton of 2000 Pounds.					
	$1.75	$2.00	$2.50	$3.00	$3.50	$4.00
	Cost of Water Gas in Cents per M. Cubic Feet.					
7,500	13.2	13.8	14.9	16.0	17.1	18.2
11,250	10.3	11.0	12.0	13.2	14.3	15.4
15,000	9.1	9.7	11.0	12.0	13.2	14.2
22,500	7.9	8.4	9.6	10.8	11.9	13.0
30,000	7.3	7.9	9.0	10.2	11.3	12.5
45,000	6.5	7.0	8.2	9.3	10.3	11.5
60,000	6.0	6.6	7.8	8.9	10.0	11.2

TABLE 3. TOTAL COST CHARGED TO PRODUCTION OF WATER GAS ONLY IN SINGLE UNIT PLANTS WITH BITUMINOUS COAL.

Plant Capacity, Cubic Feet per Hour.	Price of Coal per Net Ton.					
	$1.75	$2.00	$2.50	$3.00	$3.50	$4.00
	Cost of Water Gas in Cents per M. Cubic Feet.					
15,000	11.9	12.3	13.3	14.8	15.8	17.0
22,500	9.7	10.2	11.3	12.4	13.6	14.8
30,000	8.5	9.1	10.3	11.4	12.5	13.7
45,000	7.4	7.9	9.0	10.1	11.2	12.3
60,000	6.9	7.5	8.6	9.8	10.9	12.0
90,000	6.2	6.8	7.8	8.9	10.1	11.2
120,000	5.8	6.4	7.6	8.7	9.8	10.9

TABLE 4. TOTAL COST CHARGED TO PRODUCTION OF WATER GAS IN DOUBLE UNIT PLANTS WITH BITUMINOUS COAL.

The arrangement shown is what is known as a double generator set up and consists of two cylindrical generators lined with firebrick and firebrick arches at the bottom for supporting the fuel.

The exhauster is driven by a small gas or steam engine or electric motor, and maintains sufficient vacuum on the fires to create a draft down through the fires and pressure enough to deliver the gas into the gas holder.

Valves *C* and *D* control the course of the gas delivered by the exhauster. The purge stack valve *C* is only opened when kindling new fires and getting the fires to a proper temperature for gas making,

and as soon as this condition is reached, valve *C* is closed and valve *D* opened, and all the gas is delivered, through the dry scrubber, to the holder.

The dry scrubber is constructed of iron or steel, and contains two chambers with trays charged with excelsior or shavings.

Operation

Fires are kindled in the generators to a depth of about five feet, the exhauster creating a downward draft, with top doors *H* and *I*, and valves *A*, *B*, *G* and *C* open, and valve *D* closed. The resultant producer or generator gas is drawn down through the grates and ash pits of generators 1 and 2, valves *A* and *B* being open, passes up through the vertical boiler, and so on through valve *G* to the scrubber and exhauster. Valve *C* is then closed and valve *D* opened, and the gas is driven through the dry scrubber to the gas holder.

Coal is charged through the open top door as needed.

The making of gas is automatic according to the demand, as the speed of the exhauster is regulated by the holder so as to keep the latter full.

Each generator is provided with a door on top for charging fuel and admission of air; also with two cleaning doors above the arches and one, below the arches, opening into the ash pit.

Steam connections are made from the boiler to the ash pit and to a point above the fire, in each generator.

The boiler is of the multi-tubular type and is connected at the base with the generators, by means of brick-lined flues. These connections are controlled by water-cooled valves *A* and *B*.

All of the hot gases from the generators pass through the boiler and give up a large proportion of their sensible heat, thereby producing steam, which, in turn, is directed into the fires for decomposition when water gas is made.

The wet scrubber consists of a plate-steel cylinder provided with trays and water sprays. The trays are charged with coke. The gas inlet in the bottom of the scrubber terminates in a diaphragm that is submerged in water, and the entering gas bubbles up through the water and, in passing the trays of coke, meets with the down-coming water spray, in this manner being washed and cooled.

Plant Capacity, Cubic Feet of Water Gas per Hour.		Cost of Coal per Net Ton.					
		$1.75	$2.00	$2.50	$3.00	$3.50	$4.00
		Cost of Gas in Cents per M. Cubic Feet.					
7,500	Prod.	2.3	2.5	2.6	2.8	3.0	3.25
	Water.	7.2	7.5	8.0	8.7	9.2	9.8
11,250	Prod.	1.8	1.9	2.1	2.3	2.5	2.7
	Water.	5.5	5.8	6.2	7.0	7.6	8.2
15,000	Prod.	1.5	1.7	1.8	2.0	2.25	2.35
	Water.	4.8	5.1	5.65	6.25	6.75	7.3
22,500	Prod.	1.3	1.4	1.6	1.8	2.0	2.2
	Water.	4.1	4.4	5.0	5.5	6.1	6.6
30,000	Prod.	1.25	1.3	1.6	1.8	2.0	2.2
	Water.	3.8	4.2	4.75	5.3	5.9	6.4
45,000	Prod.	1.1	1.2	1.3	1.65	1.75	1.9
	Water.	3.3	3.65	4.2	4.8	5.35	5.85
60,000	Prod.	1.0	1.1	1.3	1.5	1.7	1.9
	Water.	3.15	3.4	4.0	4.6	5.15	5.7

TABLE 5 COST OF WATER AND PRODUCER GAS IN SINGLE UNIT PLANTS WITH BITUMINOUS COAL.

Plant Capacity, Cubic Feet of Water Gas per Hour.		Price of Coal per Net Ton.					
		$1.75	$2.00	$2.50	$3.00	$3.50	$4.00
		Cost of Gas in Cents per M. Cubic Feet.					
15,000	Prod.	2.1	2.2	2.4	2.55	2.75	2.9
	Water.	6.3	6.65	7.2	7.75	8.3	8.8
22,500	Prod.	1.6	1.75	1.9	2.2	2.3	2.5
	Water.	5.0	5.5	5.95	6.4	7.0	7.6
30,000	Prod.	1.35	1.5	1.7	1.85	2.15	2.3
	Water.	4.35	4.65	5.2	5.75	6.3	6.9
45,000	Prod.	1.25	1.32	1.55	1.75	1.9	2.12
	Water.	3.95	4.25	4.8	5.35	6.0	6.5
60,000	Prod.	1.15	1.25	1.5	1.6	1.8	2.1
	Water.	3.5	3.8	4.5	5.0	5.6	6.15
90,000	Prod.	1.1	1.2	1.35	1.55	1.7	1.9
	Water.	3.15	3.4	4.0	4.5	5.15	5.75
120,000	Prod.	0.9	1.1	1.3	1.4	1.65	1.8
	Water.	3.0	3.3	3.85	4.35	5.0	5.6

TABLE 6. COST OF WATER AND PRODUCER GAS IN DOUBLE UNIT PLANTS WITH BITUMINOUS COAL.

A Run of Gas

The gas made while air is being admitted at the charging doors is delivered to a holder only in case this producer gas is to be used. Otherwise it is wasted through the purge stack through the valve *C*.

When the fires have reached a condition of sufficient incandescence, the two charging doors *H* and *I* are closed, and either valve *A* or *B* closed; assume *B* to be closed. Steam is then admitted through the inlet *J*, after which it passes up through generator No. 2, through the brick-lined connection to the top of generator No. 1, down through the fuel bed of No. 1 generator, through valve *A* to the boiler and finally to the holder for water gas.

Water gas is the product of this operation, as before described, and is delivered to a separate holder when it is desired to use both the producer and water gas. This operation requires about five minutes, after which the fires are again blasted with air, as previously described.

On the next "run" of water gas, the steam may be admitted at *K* and pass through both generators in the reverse direction to that just mentioned.

Steam and Air Blast

By the steam inlets *E* and *F*, steam may be passed downward through both generators simultaneously.

Steam is supplied from the boiler shown, and theoretically 23.75 pounds of steam are required for every thousand cubic feet of water gas made. In practice, the amount required exceeds this considerably, about 40 pounds of steam per thousand cubic feet of water gas being used. Water is also used in the scrubber to clean and cool the gas. The quantities of water used for various purposes and for all purposes is given in Table 2.

The gas formed by the air blast is, however, a combustible one, having a calorific value of from 100 to 110 B.t.u. per cubic foot, and in the commercial operation of such an apparatus as the Loomis-Pettibone shown, the run of air gas is usually delivered to one holder and the run of water gas to another by a suitable arrangement of valves and piping. The gas in each holder may be used separately or mixed in any proportions, according to the character of the work.

Properties of Gases

The air or producer gas is an admirable gas for use in gas engines, and for some furnace work where high temperatures are not required. The water gas is an excellent fuel for both high and low temperature furnace work.

Neither of these gases have any illuminating properties, both burning with a pale-blue flame. On account of its high temperature when burning, water gas is made into an excellent illuminant by carbureting it, so called. This process consists of adding volatile hydrocarbon constituents which burn with a luminant flame, usually by the introduction of oil at high temperature in an apparatus known as the carbureter.

Carbureted water gas is not in common use except for illuminating purposes and so is not pertinent to this article.

The process of gasifying fuels in different types of producers is the subject matter of several extensive books and the reader must turn to these for more complete information, if desired.

Cost of Gas

What interests the metal worker most is probably the cost of making the gas and the results of its use.

Several factors enter into the make-up of the total cost, the principal ones being costs of fuel, labor, repairs, water, also interest on the investment, depreciation charges, taxes and insurance.

These are all variable. Depreciation may safely be figured as 5 per cent., for the apparatus is a static one of such character as to be extremely long lived. For the same reason repair charges are very small; the average for many plants being under 1 per cent. per year. Tax and insurance charges are questions of locality and construction, but no insurance at all is carried in many cases on the gas apparatus itself.

Fuel charges vary, of course, with the character of fuel and the locality of the plant, and labor costs are also governed somewhat by local conditions. An intelligent man should have charge of a gas plant, but where the plant is large enough to require the services of several helpers, these may be of the cheaper class of labor.

Tables of Costs

Tables 3, 4, 5, 6 and 7 show the cost of water and producer gas made under many different conditions. These costs are calculated for several sizes of the standard type of apparatus in most general use. This particular apparatus is probably as costly as any, so that interest charges are as high as they would be were other apparatus the basis of the calculations.

The assumptions in the case of single-unit plants are; that one operator will handle each pair of generators; the operator's pay is $2 per day and laborers $1.50; a ten-hour run per day, six days per week, and that 44,000 cubic feet of water gas is made from each net ton of coal fired. Interest on building or foundations is not included.

For double generator units, a decreased cost of gas production is assumed in the proportion brought about by using one gas holder for two pairs of generators. The operating expense is assumed to be double that of a single generator set up.

One-half the fixed and operating charges are figured against the water gas made and one-half against the producer gas made. One-half the coal is charged to producer gas and one-half to water gas. On estimating the cost of producer gas, it is assumed that each ton of fuel would yield 132,000 cubic feet of producer gas in addition to the water gas.

In Table No. 3, it is assumed that the producer gas is wasted and the total costs assessed to the production of water gas.

These costs are carefully worked out and should be a maximum, unless labor is very costly. They are calculated, as previously stated, from first costs of equipment which is probably as expensive as any.

Comparisons

Comparing the cost of gas to the cost of coal and oil is not easy, for the question of its application or use has much to do with the final choice.

A pound of coal or a ton of coal burned will develop a definite amount of heat, and when burned in a gas producer will deliver from 70 to 80 per cent. of its full calorific power in the calorific power of the gas made. It would seem then that converting coal to gas and then burning the gas was a process involving a 20 to 30 per cent. loss over burning the coal direct.

On gasifying the coal and burning the gas, however, almost the exact theoretical amount of air is used and the burnt products only of an almost perfect combustion are those that are heated. When coal is burned in a furnace, from four to ten times the theoretical quantity of air is passed through the fuel bed in order to properly burn it. Heating up this much larger volume of the products of combustion, brings down the furnace efficiency very materially.

Efficiency

For this and other reasons it may be said that a gas-fired furnace is always more efficient than a coal-fired one. The governing factor usually being in the ca-

Plant Capacity, Cubic Feet of Water Gas per Hour.	Price of Coal per Net Ton.							
	$2.00	$2.50	$3.00	$3.50	$4.00	$5.00	$6.00	$7.00
	Cost of Water Gas in Cents per M. Cubic Feet.							
1,884	22.4	24.0	25.2	26.6	27.8	30.4	32.8	35.2
4,248	13.2	14.5	15.7	17.0	18.3	20.8	23.2	25.8
4,475*	13.7	15.0	16.3	17.5	18.8	21.3	23.7	26.3
7,860	10.5	11.8	13.1	14.3	15.5	18.0	20.4	23.0
13,290	7.7	8.75	9.7	10.7	11.7	13.7	15.7	17.7
19,470	6.8	7.8	8.8	9.8	10.8	12.8	14.8	16.8
29,500	5.8	6.5	7.6	8.5	9.5	11.3	13.1	14.9
38,900	5.3	6.2	7.2	8.0	9.0	10.8	12.6	14.4

*Higher costs due to use of larger generator, with holder of double the capacity of plant above, and a much thicker brick lining, making the gas-making capacity but little greater than in preceding generator of smaller size.

TABLE 7. TOTAL COST CHARGED TO PRODUCTION OF WATER GAS IN SINGLE UNIT PLANT WITH ANTHRACITE COAL.

Gases.	CO_2	C_2H_4	O_2	CO	CH_4	H_2	N_2	B.t.u. per Cubic Foot, 60 Degrees F. High.	B.t.u. per Cubic Foot, 60 Degrees F. Low.	Efficiency of Gas over Fuel.	Loss of Efficiency in Gas Engine.	Cubic Feet Air Required for Combustion per Cubic Foot.	Where Produced.
Natural	1.5	5.1	0.1	1.3	80.1	8.4	3.5	900	811	....	9.9%	9.24	Pittsburg District.
Retort coal	2.4	4.0	0.6	6.7	32.3	49.8	4.2	568	507	69.0	10.5	5.45	Laclede Gas Co.
Coke oven	3.1	3.8	0.3	6.2	34.7	47.1	4.8	579	519	67.0	10.3	5.61	Milwaukee.
Carbureted water gas, N. Y. C.	3.5	13.0	0.5	29.8	18.6	30.5	4.1	596	551	71.0	7.7	5.89	N. Y. Consolidated
Uncarbureted water gas	3.0	0.1	0.4	43.2	2.0	48.6	2.7	315	292	58.0	7.6	2.49	Lowell, Mass.
Crude oil (Lowe)	2.0	10.0	0.2	7.3	28.6	47.4	4.5	662	603	46.0	9.2	6.21	San Francisco.
Crude oil (bench)	1.4	49.4	0.3	1.5	35.4	6.6	5.4	1158	1070	50.0	7.5	13.50	Manchester.
Commercial acetylene	0.0	C_2H_2 96.0 C_2H_4	0.8	....	....	....	3.2	1536	1382 Variable	....	10.1	11.20	Colt Co.
Gasolene mixture	0.0	50.0	10.0	....	....	....	40.0	350	314	....	8.0	6.80	Calculated.
Oil gas, Pintsch	0.5	23.5	0.5	1.0	52.5	18.5	3.5	961	876	48.0	8.8	10.43	Pintsch Lt.
Mond producer	14.3	0.2	0.4	12.0	2.6	29.3	41.2	158	140	71.0	11.2	1.31	R. D. Wood.
Taylor producer	9.6	0.2	0.5	12.8	2.1	21.8	53.1	131	122	67.0	9.4	1.07	R. D. Wood.
Dowson producer	6.6	0.3	0.2	24.8	0.4	18.7	49.0	147	138	71.0	9.0	1.12	Walthamstow.
Blast furnace	10.0	0.0	0.7	27.5	0.2	3.4	58.2	99.4	97.9	....	1.5	0.79	Illinois Steel.
Suction producer	6.8	0.2	0.8	21.2	1.3	14.8	54.9	131.5	122.5	80.0	7.1	1.16	Newton, N. J.
Loomis Pettibone	3.4	0.2	0.2	26.8	1.4	9.9	58.1	134.6	129.0	84.0	4.2	1.20	Boston L.

TABLE 8. COMPARISON OF PROPERTIES OF VARIOUS GASES.

pacity demanded. The first cost of a gas plant makes its installation of problematical economy unless a certain gas capacity is needed, and the price of coal has an influence on what this minimum capacity shall be.

Fuel oil and gas may be compared more fairly on the cost per British thermal unit basis. A thousand cubic feet of water gas will have a calorific power of about 300,000 British thermal units and a gallon of fuel oil will have a calorific power of approximately 130,000 British thermal units, per gallon, so that the cost of one thousand cubic feet of gas should be compared to about 2.31 gallons of fuel oil in order to ascertain comparative heat generation per unit of cost.

In the actual application of these two fuels, this ratio does not hold, but is considerably in favor of the gas, as will be seen from a discussion of the application to various purposes.

In general, it is safe to assume that water gas may cost 2.275 times as much in cents per thousand cubic feet as oil does in cents per gallon, when each is to do the same service at the same cost. To put it in the form of a proportion; cost of oil in cents per gallon is to the cost of water gas in cents per thousand cubic feet as 1 is to 2.275 when equivalent work is done by each.

In Table 8 are given the properties of various gases and a comparison of the different kinds can easily be made from this as to their composition and efficiency.

New Plant of Gardner Machine Co.

By M. E. Hoag

A concrete building, with large glass areas, concrete floors and roofs and modern arrangements for heating, lighting, distribution of power, etc. Unit costs are given.

Ground was broken July 28 last for the new plant of the Gardner Machine Company of Beloit, Wisconsin. The new building is being constructed entirely of reinforced concrete; the only wood is in the window frames, window sash and office trimmings.

The structure will be of the monitor type, 100 feet wide by 200 feet long. See the section shown as Fig. 1. The central span is 40 feet wide and will be used as a crane-way for handling heavy machinery and heavy castings. The side bays are 30 feet wide.

On the southern end for a distance of 40 feet the building is two stories in hight, and this space will be used for the offices.

Under the entire building is a basement to be used for storage and as a space through which pipes, wires and the like can be easily run in order to reach all parts of the manufacturing area. In this basement at the northern end of the building the furnaces and boilers of the heating plant will be located.

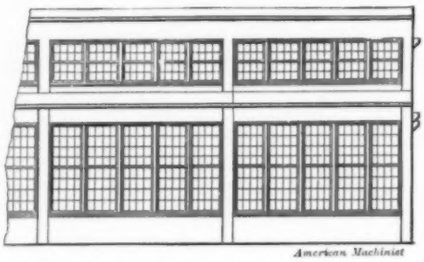


FIG. 2. PARTIAL SIDE ELEVATION, SHOWING GLASS AREA

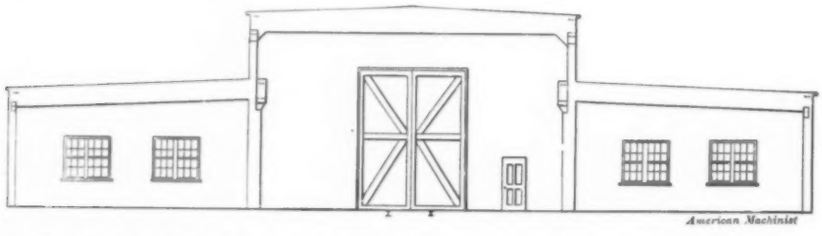


FIG. 1. REAR ELEVATION OF NEW FACTORY OF GARDNER MACHINE COMPANY

An interesting feature of the concrete construction is the roof of the middle bay, which is spanned by reinforced concrete girders 40 feet in length.

The roof itself will be of solid concrete, covered with 5-ply tar and gravel. No provision is deemed necessary for the removal of snow or ice.

The floors are to be of cement throughout the manufacturing and storage areas, and of hard maple in the offices.

The finish of the walls on the inside is to be with a cold-water paint, which will diffuse the light and practically do away with all shadows.

DATA

The questions of unit costs and unit factors are always of value in connection with a manufacturing plant. In this case the cost per square foot of floor area, including the storage basement, is 76 cents. The cost per square foot, excluding the storage basement, is $1.20. Again, the cost per cubic foot of volume for the entire plant is 5.8 cents, and for the manufacturing area, excluding the storage basement, is 7.4 cents. In passing it should be stated that the clear ceiling hight in the basement is 7 feet, and that the depth of the beams supporting the ground floor is 2 feet.

An important feature of the plant is the large amount of glass area. This is indicated by Fig. 2, which is a portion of a side elevation. The total number of square feet of glass in the plant is 4800, giving factors of one square foot of glass for each 9.4 square feet in the entire plant. In the main shop, where the manufacturing and assembling work will be done, this factor, however, is considerably different, for there we find one

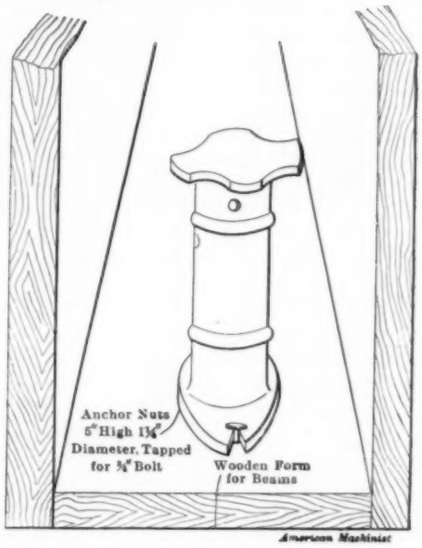


FIG. 3. ANCHOR NUT AS SET IN FORM FOR CONCRETE

square foot of glass for each 4.8 square feet of floor area. These factors are worked out for the actual glass area in the windows, excluding frames and sash. All of the windows in the factory proper will be of factory ribbed glass, excepting in the lower sash of the shop windows and all of the office windows; these will be glazed with clear glass.

Something over 6000 square feet of direct radiating surface is provided in the steam-heating system. This gives a factor of 75 cubic feet of room volume per square foot of direct radiating surface.

The lighting will be by means of tungsten clusters for general lighting, and individual incandescent lights over benches, machine tools, desks, etc. Current is to be supplied by the local electric companies.

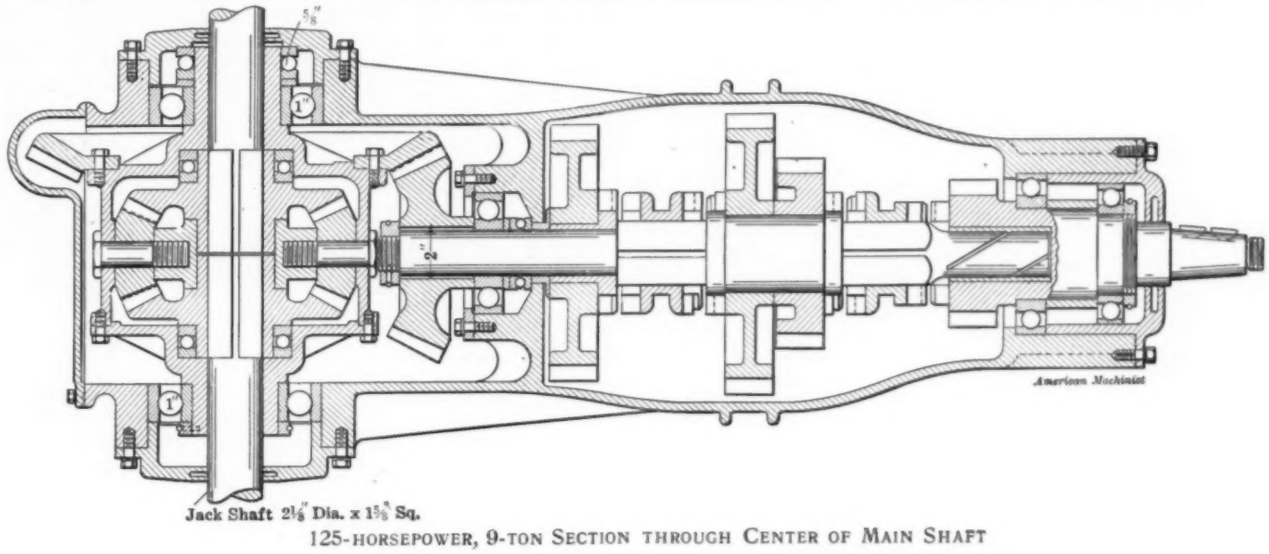
Power, the same as light, will be supplied by the local electric power company and distributed in small units. The motors are to be mounted on brackets attached to the main columns and raised about 12 inches above the floor. One 15-horsepower motor will be used exclusively for testing out finished machines before they are shipped.

The line-shaft hangers will be the Hess-Bright ball bearing type, attached to wooden stringers, which in turn will be fastened to the roof by means of anchor nuts imbedded in the concrete, and bolts. The nuts are set with a spacing 48 inches between centers. The countershafts will be supported in the same manner as will also the crane rails. Fig. 3 shows an anchor nut and the method of setting it in the wooden form before the concrete was poured.

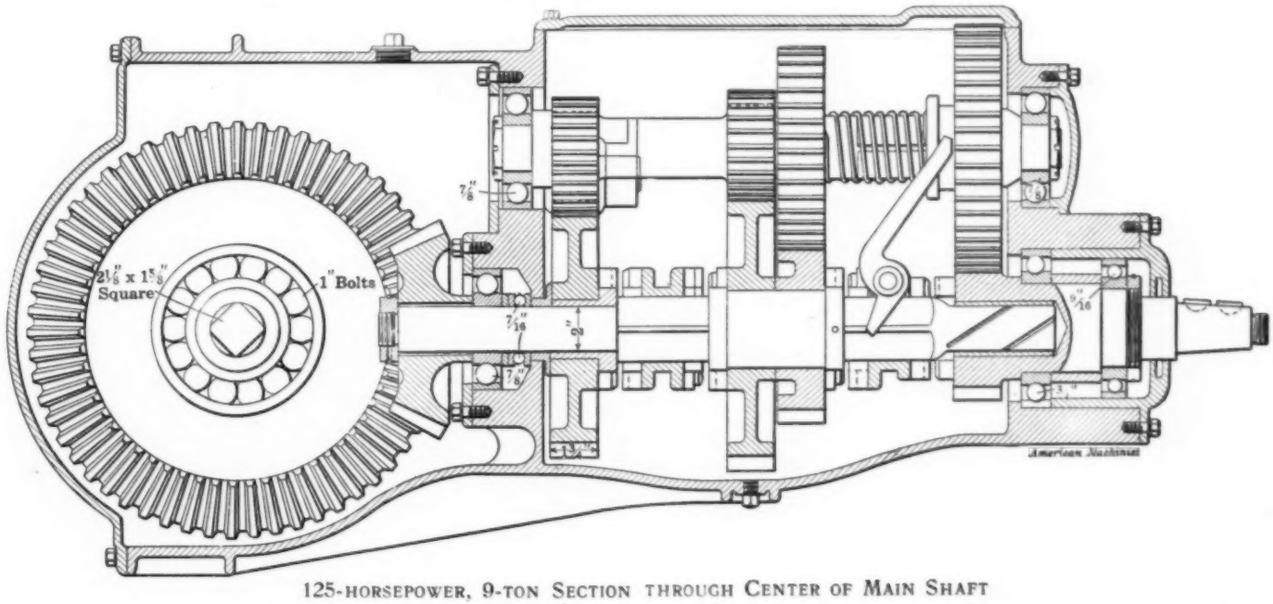
The transportation facilities inside the building will consist of a 5- to 10-ton electric crane, running the entire length. Railroad connection is provided by means of a joint switch, reaching the Chicago & Northwestern and the Chicago, Milwaukee & St. Paul Railroads. This spur will enter the north end of the building for a distance of 50 feet.

Transmission for Motor Fire Engine

We illustrate herewith one of the largest transmissions we have seen, being made by the Cotta Transmission Company, Rockford, Ill., for a fire engine that is under construction by the Nott Fire Engine Company, of Minneapolis, Minn., for the city of New York.



125-HORSEPOWER, 9-TON SECTION THROUGH CENTER OF MAIN SHAFT



125-HORSEPOWER, 9-TON SECTION THROUGH CENTER OF MAIN SHAFT

The main dimensions are given on the illustrations, among the interesting features being the large-sized balls in the bearings and the heavy gears, which have 3½ diametral pitch. The gears for first, second and third speeds and reverse are:

Main shaft	37	24	18	33
Countershaft	13	26	32	17/17

The 33-tooth gear in the reverse meshes into a 12-tooth gear, and the 18-tooth gear is an idler, which reverses the direction of motion.

These gears have 1⅞-inch face.

The differential gears have 56 and 28 teeth of 2¼-inch face. It will be seen also that the change gears and differential are integral in one rigid cast box frame.

Flats on Hobbed Gear Teeth

By Ralph E. Flanders*

Mr. Grant's belated discovery of the flats on hobbed-gear teeth has stirred up a very interesting discussion; and now Professor Sweet has entered that discussion with a question of considerable importance. In substance, his inquiry is as follows: "Do not the Bilgram, Gleason and Fellows machines also suffer under the disadvantage of approximating the true tooth curve by a series of flats? Are they any better in this respect than the hobbing machine?"

In Figs. 1 and 2 are shown the conditions which produce the flats on a hobbed gear. In the first case an exaggerated condition is shown; the hob is supposed to have but one row of teeth. Under these conditions a very poor approximation indeed is produced, the tooth outline being formed of only two flats, with a little nick in one of them just about at the base line.

In Fig. 2 the hob has been provided with three flutes or rows of teeth, resulting in a vast improvement. The acting outline of each tooth, above the base line, is now formed by a series of six flats, closely approximating the involute. If the number of flutes or rows of teeth had been doubled, the number of flats would have been doubled also. The number and fineness of the flats on the involute are in direct proportion with the number of flutes in the hob.

Fig. 2 shows plainly how the exact number of the flats may be determined. Line *A B C* is the line of action, along which contact between the gear and the hob (or the corresponding rack) takes place. The dotted lines marked 1, 2, 3, etc., show the successive positions of the cutting edge as the rotation of the hob brings one after another of the three rows of teeth into action. There are as many flats on each tooth of the work as there are lines 1, 2, etc., which cross line *A B C*. There are five of these crossing lines; but line *O* overlaps in its action somewhat, clipping off the top of the tooth as shown. Doubtless, line 6 overlaps also close to the base line, but its effect is so slight as to be undiscoverable.

In contrast to the hobbing machine, in which the number and fineness of the flats depends on the number of flutes or rows of teeth in the hob, the number of flats in the Bilgram, Gleason and Fellows machines varies with the rate of the feed, and is in any case immensely greater. Under any practical conditions, in fact, their number is so great that they give a surface indistinguishable from the involute by any possible means, and if there were any possibility of trouble from the flats being too wide, it could be obviated by reducing the feed.

Should the operator be desirous, however, of producing on the Bilgram, Gleason or Fellows machines, flats like those on the hobbed gear, he can accomplish his purpose very easily. All he will have to do is to withdraw the index worm from the index wheel until it runs with a little play. He can have flats to his heart's content, so long as the index wheel is not closely controlled by the worm.

It should be noted that the Fellows cutter is entirely flatless. There is no step-by-step motion at all in its generation. The whole operation is continuous rolling motion, giving the cutter the true continuous involute curve shown in the illustration of perfect generation in Fig. 3.

To sum up, then, the flats of the hobbed gear are comparatively few and coarse; their number depends on the number of flutes in the hob, and on nothing else; they cannot be made finer by making the feed finer. On the other hand, in gears generated on the Bilgram, Gleason or Fellows machines the flats are so many in number as to be undiscoverable; their number depends on the rate of feed; and they can be made finer by making the feed finer, though the flats are so fine that there is no necessity for so doing on that account.

It may be mentioned that, with a properly designed hob, all the flats in Figs. 1 and 2 will be tangent to the involute. Mr. Grant is in error (if I understand him correctly) in supposing that only at the pitch line can a flat be tangent to the involute.

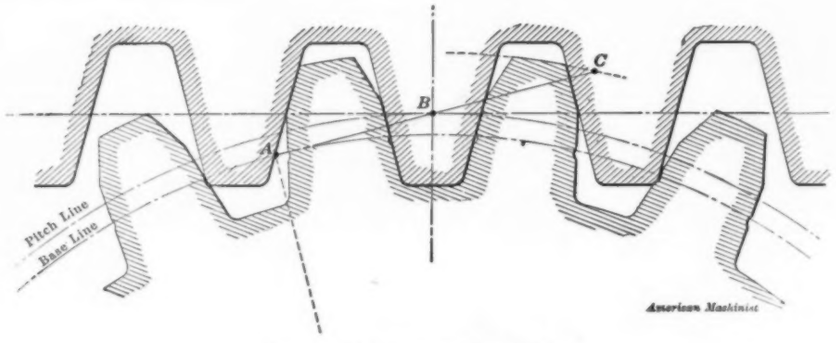


FIG. 1. ONE ROW OF HOB TEETH

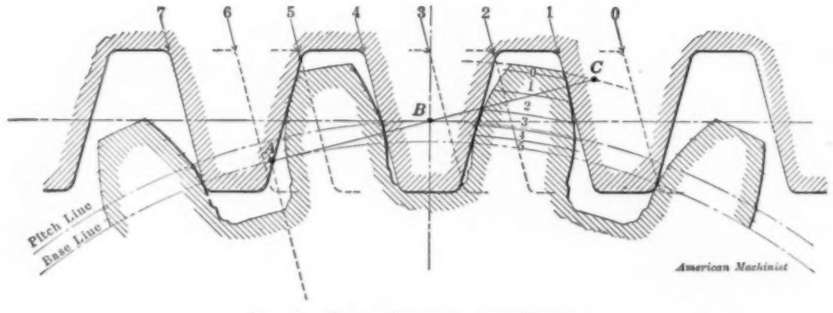


FIG. 2. THREE ROWS OF HOB TEETH

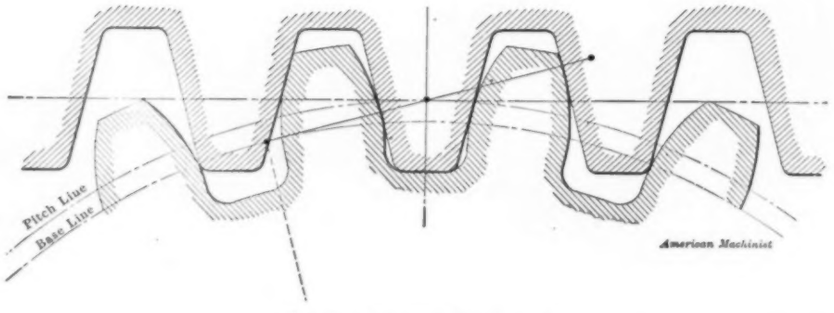


FIG. 3. PERFECT GENERATION

THE PRODUCTION OF FLATS ON HOBBED GEARS. THE EXAMPLE SHOWS 21 TOOTH GEARS OF 14½ DEGREES PRESSURE ANGLE

*With Fellows Gear Shaper Company.

Design of Hydraulic Press Rams

By A. Lewis Jenkins*

As the distribution of the material being pressed is nearly always uneven, it is most important to take care of the stresses produced by eccentric loading.

Hydraulic press rams usually being hollow, stresses due to external liquid pressure must be combined with those produced by the compressive load.

*Assistant professor of mechanical engineering, University of Cincinnati.

The ram or plunger for a hydraulic press consists essentially of a simple cylinder closed at one end and does not permit of much variation in general outline. The most pronounced difference is shown in Figs. 1 and 2 and is due to the methods used in packing the cylinders. When the packing is placed on the end of the ram, as shown in Fig. 1, the bore of the cylinder is well finished, or fitted with a copper lining, the body of the ram being about ½ to 1 inch smaller in diameter than the cylinder and provided with a finished flange at the bottom to receive the packing. There is sometimes a flange at the top also, to receive the platen. When a stuffing box, or U-leather packing in the neck of the cylinder is used, it is necessary to finish the ram all over, with the exception of the bottom.

This latter method has proved more satisfactory and economical for presses operating with oil as a working fluid, because the outside of a cast cylinder is less liable to flaws and more easily machined than the inside. The serious objection to the outside-finished ram lies in the fact that if water is used as a working fluid, it is liable to become injured by rust. This objection may be overcome, however, by encasing the ram in a brass cylinder or by electroplating its surface with copper.

Aside from the above mentioned variations in design, the bottom of a ram may be flat or spherical, as shown in Figs. 2 and 3, and may also be provided with a "stop boss" if supported by the bottom of the cylinder when the pressure is off. All rams that are not solid should be provided with a stay, usually about 1½x2 inches in cross section, placed across the open end about ½ inch from the top, which permits of its being easily held in the lathe and is also found convenient when removing it from the cylinder.

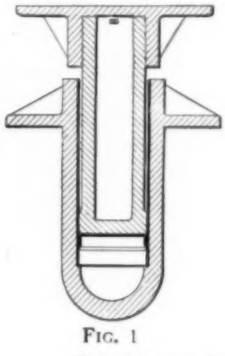


FIG. 1

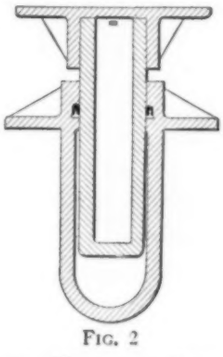


FIG. 2

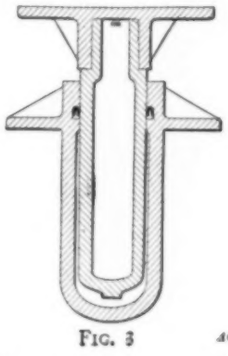


FIG. 3

METHODS OF PACKING HYDRAULIC PRESS RAMS

FIG. 4

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ECCENTRIC LOADING

LOADING

In many presses the resistance at the beginning of the stroke is relatively small and increases to a maximum at the end of the run. In this case the condition for maximum load occurs when the ram is merely acting as a column. If the load does not vary with the stroke, it will become maximum before the end of the run and the ram must satisfy the condition of a column and a cylinder subjected to external pressure.

The distribution of the load on the platen is of extreme importance to the designer, but owing to the wide application of the hydraulic press there seems to be no experimental or analytical method by which the exact distribution of the load may be determined. For such machines as hot plate, cotton-seed oil, veneer and belt presses, and machines for making billiard balls, graphophone records, etc., the load may be assumed as acting through the center of the ram; whereas, with large presses for baling hay, cotton, waste paper, tobacco and various other materials the load is usually eccentric because it is not practical to distribute the material evenly in the box or bale.

About all the designer can do is to make a relative comparison between the apparent working conditions of the proposed machine and some other that is successfully performing a similar duty. Hence it is found that the thicknesses of certain rams are frequently the result of evolution and are not easily checked by calculation.

There is much to be said in favor of the evolution method of design from a practical standpoint, but unless it is based on wide experience and reliable data, it is dangerous. This fact was forcibly brought to my attention some time ago when consulted on the problem of redesigning the rams for a bank of 78-ton baling presses. These machines had a 35x60-inch platen; run of ram 120 inches, and the ram was made of cast iron, 10 inches in diameter and 1⅝ inches thick. They were used for baling waste paper of all descriptions, including old books and newspapers. They performed their duty with some satisfaction when handling paper in the form of small ribbons, but when loaded with old books and bundles of newspapers the rams would invariably fail just below the platen boss. Upon investigation it was found that the designer had used proportions only suitable for uniform load and had not recognized the importance of investigating the ram as an eccentrically loaded column. By assuming the eccentricity of the load to be equal to $2R$, the results of a calculation showed that the stress would not be within limits of good practice, if it be made solid.

For machines used for general purposes, having a short run of ram, it is good practice to use a liquid pressure of 1000 to 1500 pounds per square inch, and determine the diameter from the given load and assumed pressure; but under some conditions this method cannot be followed, because the ram would be so small that it would fail as a column. An example of this condition exists in a machine for compressing tobacco in hogsheads for shipment. The platen is about 60 inches in diameter and it is extremely difficult to pack the tobacco so uniformly that the resultant reaction of the load will pass through the center of the ram. By using 1000 pounds liquid pressure the ram would be unsafe if made of cast iron or even steel, and a much better machine would result from using a lower pressure.

The conditions of eccentric loading and side thrust are well met by using two cylinders and a guided crosshead or platen similar to that used on the forging press shown in Fig. 6. The pressure

is transmitted to the crosshead by two spherical-ended "push rods;" one end fitted to socket bearings in the ram and the other abutting against the crosshead. To maintain parallelism, the crosshead is provided with an upwardly projecting shank which is guided in a cylindrical bearing placed between the pressing cylinders, and the side thrust is taken by the strain rods, or columns, thereby relieving the ram of all bending stresses.

Materials

The rams of presses for ordinary purposes are usually made of cast iron, but very large machines working on high liquid pressure often require the use of steel castings or forging. Steel rams are the most reliable and present an excellent surface which prolongs the life of the packing and increases the efficiency. Delta metal is sometimes used when iron or copper would corrode. Until comparatively recent years, wooden rams were frequently used on certain machines having a capacity of 50 tons or less.

Thickness

The thickness of the walls of a hollow ram depends upon its length, distribution of the load and pressure per square inch of the liquid. The fundamental stresses in the walls are as follows: (a) the compression hoop stress due to the external pressure; (b) compressive stress due to direct action of the load; (c) bending stress (tension and compression) due to eccentric loading or buckling.

In developing formulas for the stresses involved the following notation is used:

A = Cross-sectional area of hollow ram, in square inches;
A' = Outside area of bottom, in square inches;
C = Distance from neutral axis to outside fiber, inches;
D = Outside diameter of ram, inches;
E = Modulus of elasticity.
e = Eccentricity of load, or distance from the resultant of the reaction on the platen, to axis of ram, inches;
I = Moment of inertia of ram cross section;
K = Constant $= \frac{e}{R'}$
L = Length of ram in inches;
P = Liquid pressure, in pounds per square inch;
r = Inside radius of ram in inches;
R = Outside radius of ram in inches;
S = Unit stress in pounds per square inch;
S_h = Unit hoop stress;
S_c = Unit compression stress;
T = Thickness of rams in inches $= R - r$;
T' = Thickness of bottom of ram;
W = Total load on bottom of ram.

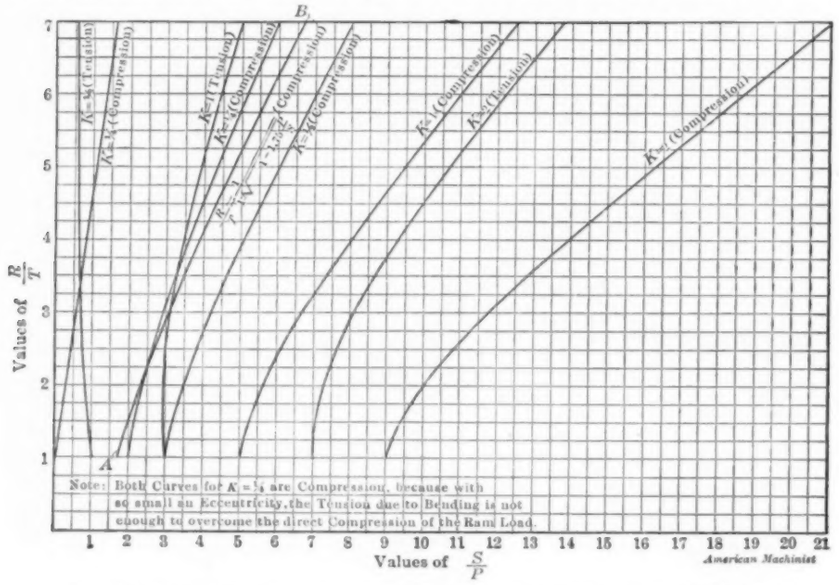

Values of $\frac{R}{T}$
Values of $\frac{S}{P}$
Note: Both Curves for $K = \frac{1}{4}$ are Compression, because with so small an Eccentricity, the Tension due to Bending is not enough to overcome the direct Compression of the Ram Load.
American Machinist

Fig. 5. Curves for Determining Stresses in Hydraulic Press Rams

Rams with short runs, and centrally loaded, may be considered as cylinders subjected to external pressure and direct compression. According to Lamé, the maximum stress in a thick cylinder subjected to external pressure is a compression-hoop stress at the inner surface and may be found by the formula:

$$S_h = \frac{2R^2P}{R^2 - r^2}.$$

The compressive stress, due to the direct action of the load is expressed by the equation:

$$S_c = \frac{W}{A'} = \frac{\pi R^2 P}{\pi (R^2 - r^2)} = \frac{R^2 P}{R^2 - r^2}.$$

From these equations it is seen that:

$$S_h = 2 S_c.$$

By assuming ¼ for Poisson's ratio and combining these two compression stresses, the equivalent hoop stress is:

$$S = S_h - \tfrac{1}{4} S_c = \tfrac{7}{8} S_h = \frac{1.75 R^2 P}{R^2 - r^2}.$$

This equation may be reduced to the form

$$\frac{R}{T} = \frac{1}{1 - \sqrt{1 - 1.75 \frac{P}{S}}},$$

and the relation between $\frac{R}{T}$ and $\frac{S}{P}$ is shown graphically by the curve $A\,B$ in Fig. 5. According to this formula the values of T for pressures less than 2000 pounds per square inch seem small compared with values used in practice, but it is to be remembered that most presses do not give the ideal conditions assumed by this formula. The values given in Mark's "Hydraulic Power Engineering" are expressed very well by the parabola

$$T = 1 \sqrt{0.31 D}.$$

An eccentric load tends to increase the stress on one side and decrease it on the other, and if the eccentricity is sufficiently great, one side may be in tension. A ram carrying a load W placed at a distance e from its axis, as shown in Fig. 4, is subjected to a compressive stress $\frac{W}{A}$, and a bending stress equal to $\frac{Wec}{I}$, hence the maximum resulting stresses are:

$$S = \frac{W}{A} \pm \frac{Wec}{I}.$$

The positive sign gives the compressive and the negative, the tensile stress. By substituting the values of W, A, c and I in terms of R, r and P, the equation may be written:

$$S = \frac{R^2 P}{R^2 - r^2} \pm \frac{4 R^2 P e}{R^4 - r^4}.$$

From this it may be seen that the eccentricity which will produce zero stress at one point on the perimeter, and

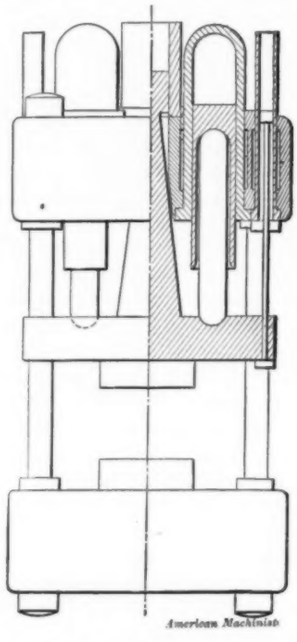


Fig. 6. Forging Press with Guided Crosshead

doubles it at a point diametrically opposite is:

$$e = \frac{R^2 + r^2}{4R}$$

for a hollow ram, and it may be proved that for a solid ram it is:

$$e = \frac{R}{4}.$$

Substituting KR for e, in the above equation and solving for $\frac{S}{P}$ in terms of $\frac{T}{R}$ it becomes

$$\frac{S}{P} = \frac{1}{1 - \left(1 - \frac{T}{R}\right)^2} \pm \frac{4K}{1 - \left(1 - \frac{T}{R}\right)^4}.$$

This equation is plotted in Fig. 5 for the values of e equal to $\frac{1}{4}R$, $\frac{1}{2}R$, R and $2R$, and the thickness for these values of e may be readily found from the curves.

To show the use of these curves, suppose the radius of a ram is 5 inches, thickness $1\frac{5}{8}$ inches, eccentricity $= 2R$ and pressure 2000 pounds per sq.in.; and it is desirable to find the maximum stresses. $\frac{R}{T} = 3$, and from the chart, $\frac{S}{P} = 8.2$ (tension) and 11.75 (compression), and the tensile and compression stresses are respectively equal to 16,400 and 23,500 pounds.

Rams having runs, approaching the condition of a plunger for a hydraulic lift, may be treated as a long column. For this case it is well to use a modification of Euler's formula which is written:

$$B = \frac{15\,EI}{L^2},$$

Where B = ultimate or breaking load in pounds.

The serious objection to making flat ends on cylinders does not apply to rams as the cone of crystallization is in compression and is not a source of weakness. The thickness of flat ends may be found from the formula

$$T^1 = \sqrt{\frac{3\,r^2 P}{4\,S}}.$$

Some designers use ribs to strengthen the bottom as shown in Fig. 4, but there is some doubt about its being good practice.

The thickness of a spherical end having a radius less than the diameter of the ram is usually made equal to the thickness of the walls.

Casting Hubs on Steel Spoked Wheels

By W. E. Ely

A method by which a steel-spoked wheel can be made cheaper with a steel than with a cast-iron rim.

The apparatus and method of molding and casting the cast-iron hub, locating the rim and placing the spokes.

I visited a foundry the other day where they were making a wheel about 3 feet in diameter with a cast-iron hub and rim and a single row of steel spokes. Arms were made on the pattern to make an imprint in which the steel spokes could be laid. The spokes being smaller than the print, the molder had to fill in sand to shut off the space on each side of the spokes, both at the rim and the hub. He could only make two for a day's work as they had to be rammed up in a large flask.

This reminded me of a different method for molding these wheels. The company where I was formerly employed made wheels of different sizes in diameter and width of rims but the same outfit was used for all sizes; the hubs only were cast in dry sand, the rims and spokes being steel.

A stand is first made as shown in Fig. 3, with a flat part, about 1 foot in diameter, that has a ridge around the edge ½ inch wide and ½ inch high to act as a guide for the first core placed. Three arms extended about 1 foot 8 inches out from the center and on the end of each was a raising block set on loose. This block, as shown, had steps cut on it corresponding to the different widths of the rims so as to bring them to their right positions. After being welded in the blacksmith shop, the rims for these wheels were taken to the machine shop to be drilled and countersunk for the heads of the spokes. The completed wheel is shown in Figs. 1 and 2.

It required 7 cores in the molding. These are a nowel, or bottom core, three cheek or middle cores, a cope or covering core, a center core and an oil-hole core. These cores when made were given a heavy coat of black lead before drying, which gave the hub a smooth finish free from scabbing. They were made one day, dried in the oven over night and used in the morning.

The nowel or bottom core was made about 1 inch larger in diameter than the rest and had a ridge about ½ inch wide and ½ inch high around its edge to act as a guide for the upper cores. This nowel core also contained the bottom print for the center core, and is set first, as shown at Fig. 4. The first cheek core is next set. It fits in the guide made on the nowel core and forms the hub as far up as the center line of the first row of spokes.

The spokes are dipped in red lead so as to do away with the dangers caused by rust and then put through the rim, which has been placed on the arms of the stand and laid in position in the prints made by the first cheek core. The second cheek core is then put on and serves to hold the spokes in place and forms the center line of the hub.

The small oil-hole core is next placed

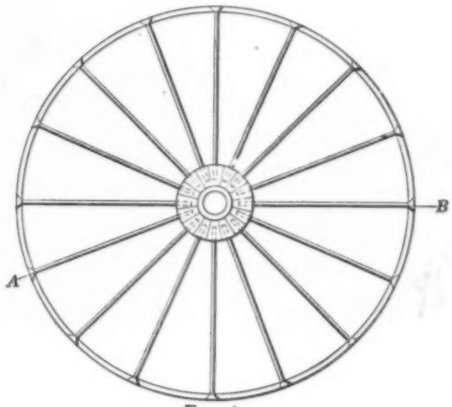


FIG. 1

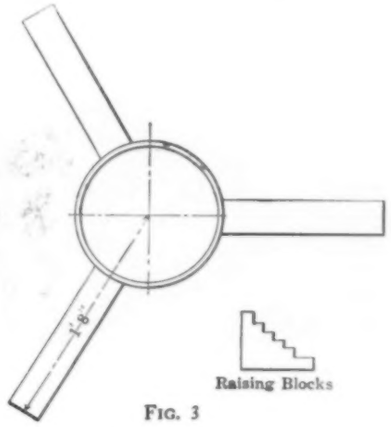


FIG. 3

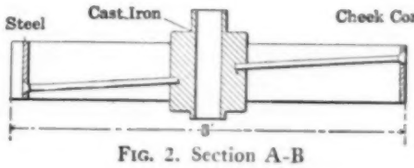


FIG. 2. Section A-B

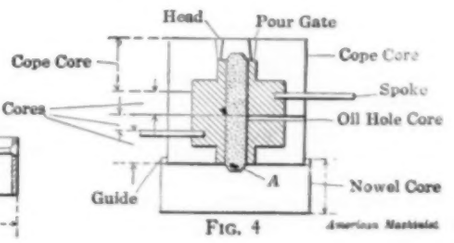


FIG. 4

CASTING HUBS ON STEEL-SPOKED WHEEL

it being half in the second cheek and half in the third. Then comes the third cheek core which forms the hub as far up as the center line of the second row of spokes, which are next placed in position.

The center core is now set and the cope or covering core put on. This core holds the second row of spokes in position and completes the forming of the hub. It also holds the center core central and from raising. The gate and riser, or head, are cut through this cope core.

The mold is then clamped, two clamps being sufficient to hold it. These clamps were made with a set screw in the top and an iron plate was placed between the screw and the sand so as to prevent cracking the core when tightening. The joints were then daubed with clay so as to prevent a possible run-out.

It took about 90 pounds of iron to pour the hubs of these wheels and they were left to stand over night. Next morning, while the set of cores that had been made the day before and had just left the oven were cooling, these wheels were torn down and the same operation continued as the morning before.

By this method a coremaker and a helper can make from 8 to 16 wheels for a day's work, with little danger of loss, while by the first method a molder made but two wheels in a day. There was also a much greater danger of loss in castings and a rougher job. Another point is that the steel rim wheel is stronger and more durable than one with a cast-iron rim.

In locating the rim so that the hub will be in the center, a radial arm was swung from the center of the stand, and the rim was adjusted till this arm touched all the way around. This arm was then removed before putting on the first core.

A Method of Machining Piston Rings

By Edward J. Blanchard

How the operations of boring, turning, marking and cutting off are performed with attachments on an automatic manufacturing lathe.

A method that is both simple and efficient and employs devices of recent development.

In the June number of one of the leading mechanical magazines, there appeared the following editorial under the heading of "The Piston-ring Problem": "Notwithstanding our conceded ability to solve problems in the manufacture of machinery, there seems to be no generally known, first-class method of cheaply making piston rings for gas engines. By that we mean a method that can be depended on to turn out truly circular, well finished, even tension rings at low cost. The commercial methods in vogue are inaccurate, costly and unsatisfactory in result.

"The makers are not able to control all the factors entering the problem, and must follow more or less happy-go-lucky processes quite repugnant to the ideals of mechanics accustomed to precise methods of production. A practice that will turn out perfect rings, interchangeable and of uniform tension, is yet to be described."

In this I do not propose to discuss the finishing of piston rings complete, but will only deal with the machining of the rings as far as the boring, turning, marking and cutting off are concerned. The method employed is very simple and efficient, and embodies many recent improvements.

Particular mention might be made of the automatic marking device, that is part of the piston-ring tool equipment. This marks the rings at the low and thin point for parting. This feature of the equipment is undoubtedly superior to anything at present used for this purpose. It not only saves time, but also assures each ring being marked in the same place.

The method of machining piston rings herein described is used with an attachment designed and built by the Potter & Johnston Machine Company, of Pawtucket, R. I., and may be applied to any of its 5A or 6A automatics. The rings made will vary in uniformity from 0.001 to 0.004 of an inch, according to the length of the castings. The first ring cut off will vary from the last, there being more play to the outer end of the casting than there is near the chucking piece.

In order to obtain the best results and the greatest uniformity, the piston-ring castings should be made from a pattern sufficiently long to finish from eight to a dozen rings, according to size, with solid and tapering chucking end.

In Fig. 1 is shown the piston-ring tools with a casting partly turned. Fig. 2 shows the rings cut off and resting on the ring carrier. In this picture the rings have all been arranged so as to show the marks.

The piston-ring casting or pot, as it is very often called, is held in special hardened-steel jaws *A*, on the standard chuck *B*, which is furnished with each machine. These jaws are bored taper and will draw the casting firmly against a seating. They are operated with a socket wrench. The rings are bored by a tool carried in the steel piloted bar to which is fastened the ring carrier *C*. A small adjusting

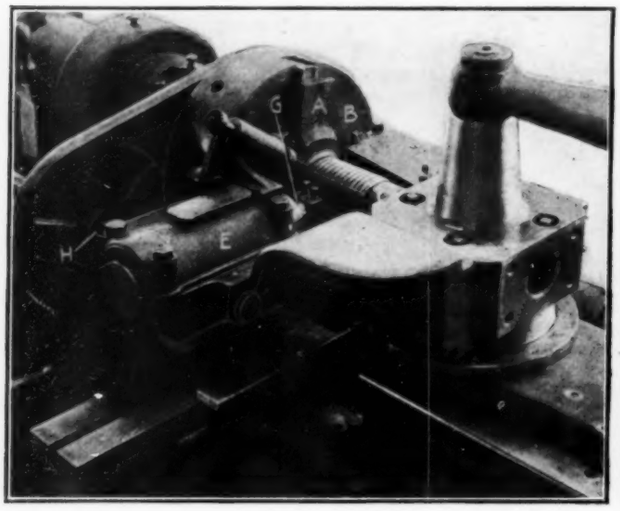


FIG. 1.

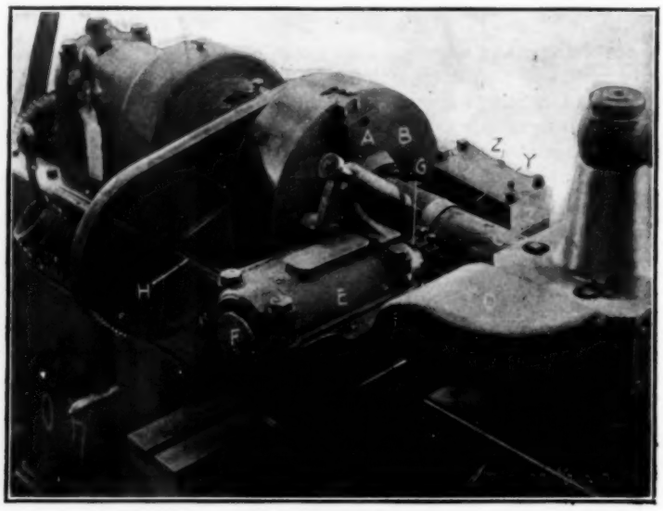


FIG. 2.

PISTON-RING TOOLS WITH CASTING PARTLY TURNED AND WITH RINGS CUT OFF

screw is placed back of the tool to permit of fine adjustment. This bar is piloted for the entire length of cut, in a case-hardened and ground chuck bushing that fits the taper in the chuck plate. The ring carrier *C* is a cast-iron section screwed onto the bar and as the rings are cut off, they rest on this carrier and remain there out of the way, until taken off by the operator. This he does when he puts in a new casting.

The eccentric turning is accomplished by means of an eccentric turning fixture, which consists of a cast-iron body *D* mounted on one of the turret faces as shown. In order to make it possible to assemble this fixture, the body is made with a cover *E*, which is held in place by four screws. This body has two bearings that are bored to admit sliding rod *F* in which is carried the turning stem *G*. This stem is held firmly in the sliding rod by a screw and key and fine adjustment is provided for by a headless screw in sliding rod *F*, which comes against the back of the stem. The tool

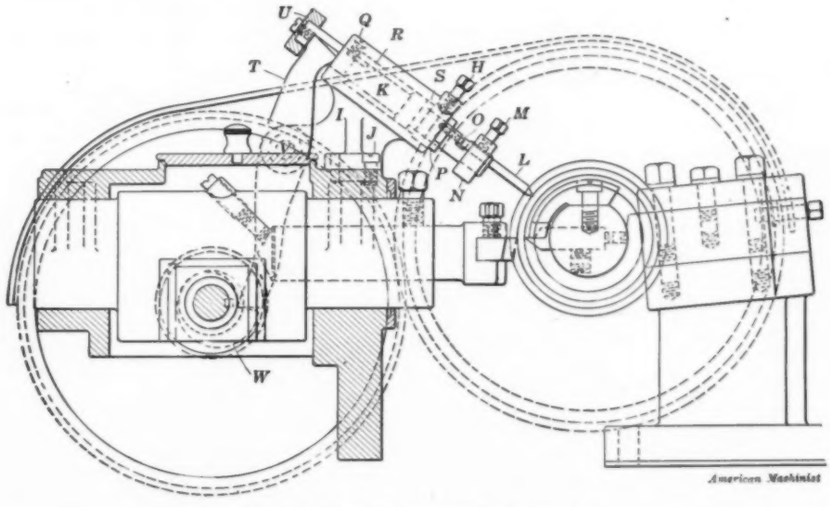


FIG. 3. THE MARKER MECHANISM

that does the turning is held in stem *G* by two screws and is very readily removed for grinding. The eccentric motion is imparted through the shaft *H*, which is geared up to the spindle. On the shaft is mounted the eccentric bushing that causes the sliding rod to travel in and out while the spindle makes one revolution.

During the time the casting is being turned and bored the automatic marking attachment is marking the low and thin point on the rings. Fig. 3 shows the mechanism of this automatic marker. Here *I* is the cast-iron marker bracket bolted to the turret bracket by screw *J*. The marker bracket is bored out to receive the marker rod *K*, which is made of steel and carries in its end marker blade *L*. This blade is made of tool steel hardened and ground, and is held onto rod *K*, by screw *M* in the steel collar *N*. *O* is a headless screw by which it is possible to secure fine adjustment for marker blade *L*. The marker rod is made a sliding fit in its bracket on one end, and in bushing *P* on the other end. It is prevented from turning by screw *Q*, the end of which fits the slot in the rod. Spring *R* is placed back of the collar on the marker rod and is compressed by the same. Another spring *S* is placed between this collar and the bushing *P*, and acts as a cushion for the marker rod when it is forced forward by spring *R*. The marker rod is cut away on the other end to receive the lever *T*. Collar *U* is held onto this end by a screw and prevents lever *T* from getting away. The lever is fulcrumed at *V* and extends down through the turret bracket, until it comes in contact with the cam *W*, which is fastened to the driving shaft. This is the same shaft to which is fastened the eccentric bushing and the arrow indicates the direction of motion.

When the shaft starts turning, the cam, through lever *T* gradually pulls the marked rod out until the high point has been reached, and then suddenly releases it. Spring *R* which has been compressed now forces the marker back to its original position with enough force to enable the marker blade to come in contact with the surface of the casting, thereby making a short line on the same. The marker bracket being fastened to the turret bracket they both advance together and a continuous line is marked on the casting. The marker blade is directly back of the cutter.

While the boring, turning and marking have been going on, a block in the rear cross slide has been gradually feeding forward and has cut off the rings so that when the casting has been machined its entire length, the required number of rings have been cut off. This block consists of a cast-iron base that is fastened to the cross slide. It is provided with a sub base *X*, in which are held the blades *Y*. These blades are held in place with the steel cap by means of screws *Z*. These blades have a slight side clearance, and are made thick enough so the slide will bear against them and not touch the sub base. Liners of the proper width and shape are placed between the blades. The block shown cuts off 16 rings and the operations are entirely automatic. The only attention required is for the operator to remove the chucking piece and put in another casting. The entire time for cutting 13 rings to the pot that are 4 inches in diameter, is 11 minutes.

Another feature of these attachments is that they can be used to finish rings from 4 to 12 inches in diameter. The only change necessary would be in the eccentric bushing, if the rings varied in eccentricity. It might also be necessary to put in different liners in the cutting-off block to suit the thickness of the rings. Or better still, a new block could be made thereby eliminating the possibility of losing any liners. If there should not be enough work to keep the machine running on rings, it can be used to advantage for machining such work as pistons, bushings, differential gears, pinions, differential crosses, etc. One operator can easily look after from four to six machines, according to the length of the operations being performed.

An invention for coping with pipe corrosion is thus described in a British publication: The new system has been invented by R. A. Adamson, the engineer of the Rivington works of the Liverpool Corporation, in which it is aimed to remove all dirt, at the same time leaving intact the black varnish lining. In the main the apparatus consists of a petrol engine to revolve a bottom shaft. An opening of 9 feet having been made in the main to be cleaned, a bracket is fixed on each end of the opening. These brackets carry two rails and a coarse-pitch screw. The petrol engine is then lowered into the hole in such a way that the wheels on the frame rest on the rails, while the screw passes through the center of the machine. The above bottom shaft is then central with the main. The frame of the machine is fitted with a handwheel to suit the pitch of the screw. By turning this wheel the machine is propelled along the rails in either direction, the bottom shaft remaining central with the main in any position. A specially constructed knife, formed by means of a central bar carrying four cutters, is used for scraping. Each cutter is held out by means of a spring, so that when the four cutters are extended, the knife is about an inch larger than the main. This allows for any inequalities in the pipe, such as a slightly oval shape, the knife opening or closing as required.

Letters from Practical Men

Civil Service Examination for Ordnance Draftsmen

The accompany list of questions was taken from a civil-service examination recently given to supply eligibles to fill vacancies in the position of skilled mechanical draftsman in the Ordnance Department at Large. The chief criticism that comes from men who have taken the examination and received appointments seems to be that it is, perhaps, more difficult than one would expect, judging from the kind of work required of the appointee. The ordnance draftsman usually does little more than common mechanical drawing, with scarcely any original design, while the examination might lead one to think that he would be expected to do a higher grade of work. This seeming inconsistency is more apparent in the ordnance department than almost any other in the Government service, and no doubt the reason for this is that the work in this department is supervised by officers of the army, who have been trained to a rigid discipline. On the other hand, there is some advantage in making this examination difficult, for its requirements tend to insure a good grade of well educated men in the drafting rooms.

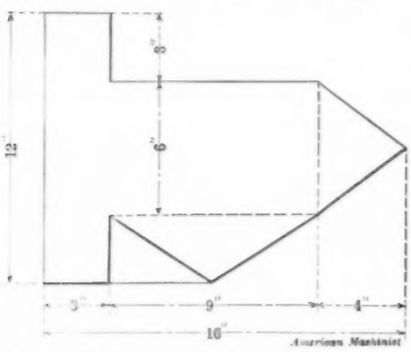


FIG. 1. FIGURE TO CALCULATE CENTER OF GRAVITY

The examination covered a period of three days of seven hours each. The subjects of mathematics and materials and construction were given the first day, practical calculations the second day, and drawing the third day. The following is only a partial list of the questions, but will give some idea of their general nature:

MATHEMATICS

1. Find the weight of a forged-steel cone, the radius of whose base is 18 inches, and the line from vertex to the center of the base is inclined at an angle of 60 degrees and is 1 foot long. One cubic inch of steel weighs 0.258 pound.

2. Draw a parabola geometrically and show clearly the method employed.

3. Describe the slide rule you have been accustomed to using and give the mathematical principle upon which it is based.

4. Find the center of gravity of the piece shown in Fig. 1.

5. A steam train weighing 200 tons runs at the rate of 30 miles per hour up an incline, which has a rise of 5 feet in 1000 feet. Find the horsepower developed.

6. The solution of an algebraic equation involving negative exponents, by logarithms.

Concerning the details of making things in machine shops, from the first sketch to the shipping room.

A letter good enough to print is good enough to pay for. The value is in the idea—not the length of the letter.

MATERIALS AND CONSTRUCTION

1. What materials, of what grade may be used for rivets?

2. What physical properties should be possessed by the material used for first-class railway springs? For boilers?

3. For what part of the construction of an ordinary steam engine is cast iron used? Forged steel? Bronze?

4. In friction gearing why should one of the pulleys be of a softer material than the other? Which pulley should be softer?

5. What is a skew gear?

6. Define by means of sketches the following terms used in gearing: Addendum, face, flank, pitch (circular and diametral), and clearance.

7. What are the five ordinary metal-working machines, and for what is each used?

8. What devices are used for keeping a nut from jarring loose? Give sketches.

9. Design a quick-return machine with a ratio of 5 to 7.

10. Design a cam where the center line of motion is to be 4 inches from the center line of cam; motion to be uniformly vertical so that for each vibration of the cam through 60 degrees the rod will travel 3 inches.

11. Make a skeleton diagram of the lever mechanism of a tensile testing machine.

12. Having given the number of threads to be cut on a screw-cutting lathe, and knowing the number of teeth in the gear on the spindle and on the stud, to find the pitch of the threads on the feed rod. (lead screw?)

PRACTICAL CALCULATIONS

1. The I-beam, shown in Fig. 2, is loaded as shown. Find the maximum fiber stress; (1), neglecting the weight of the beam, and (2), considering the weight of beam. Draw shear diagrams and bending-moment curves for both cases. Weight of 1 cubic inch of steel is 0.258 pound. For a rectangle, the moment of inertia is $\frac{bd^3}{12}$.

2. A hammer weighing two pounds and traveling 18 inches strikes a nail with a velocity of 50 feet per second. If it takes the nail $\frac{1}{1000}$ of a second to stop the hammer, what is the force of the blow?

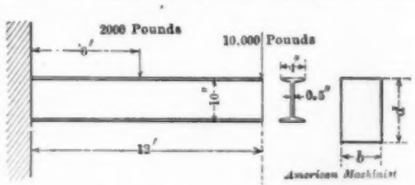


FIG. 2. BEAM PROBLEM

3. An engine weighing 4 tons goes around a curve with a radius of ¼ mile, at the rate of 60 miles per hour. What is the pressure against the rails? How high must the outside rail be, in order that the pressure be equal on the two rails?

4. A right cylinder rolls down an incline of hight *h*. What is its velocity at the bottom? Compare its velocity with that of the same cylinder were it to slide down, ignoring frictional resistances.

5. A chain hangs over a wheel so that one end hangs down 14 feet and the other end 6 feet. Draw a diagram showing the work done by pulling the chain so that the long end hangs one foot below the short end. The chain weighs 3 pounds per foot.

6. A rack with 1-inch pitch is moved by a gear with 50 teeth. If a pressure of 50 pounds be applied at the end of a wrench handle 14 inches long, what force will be exerted on the rack?

7. The twisting moment of a shaft is

15,000 inch-pounds, the bending moment 8000. To what twisting moment are these two equal? What size steel shaft will be required?

DRAFTING

This part of the examination consisted in detailing to scale, a traverse brake consisting of eight parts, having given the assembled drawing, not to scale. An ink drawing on paper and a tracing on tracing linen were required.

Scranton, Penn. S. HURLEY.

Laying Out a Crown Spiral Gear

In applying autometers to motorcycles, it is necessary to use a crown-spiral gear, or what is sometimes known as a "snail gear," and it may be of interest to some of the readers of the AMERICAN MACHINIST to know how the patterns for these gears were laid out.

The gear used as an illustration is 12-toothed, and engages a 12-tooth, 12-pitch pinion; a No. 7 cutter being used to cut the pinion, instead of a No. 8, as is regular practice.

The layout as first made is shown in Fig. 2, and it readily will be seen that the teeth gradually converge as they approach the point *a*, instead of remaining parallel; so that a pinion tooth that will fit at the entrance will be too tight by the time it has passed partly through. Fig. 1 shows the layout that solved the problem and was sufficiently accurate for all practical purposes.

In making the pattern the brass gear blank was cast, and turned up all over. A circle of sheet steel was fitted into the center opening, and tacked in place with solder; the 12 radial lines marked, and a small hole drilled in the center. A layout was made on sheet steel and filed up, as shown in Fig. 3, the line *a b* corresponding to the form of the inside edge of a tooth in the gear. A hole was drilled in the center, to take a pin that fitted the hole in the center of the gear.

With a formed tool the shape of the gear tooth, a mold was turned in a piece of cast iron, the radius being 3 3/32 inches, as in Fig. 2. The arc *c d* being nearly the form of the tooth layout in Fig. 1, the teeth required very little bending and consequent distortion. The gear teeth were then cast of soft babbitt.

Templet shown in Fig. 3 was placed on the gear pattern and clamped in position; the babbitt gear tooth brought up against the edge and fastened with three or four small rivets. The templet was then advanced 30 degrees, and the next

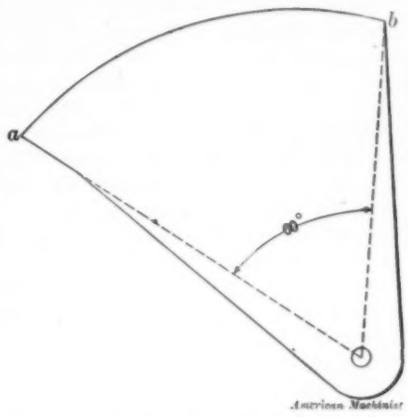


FIG. 3. THE TEMPLET

tooth fitted; and so on, until all 12 were in place. From this master pattern, brass patterns were cast and finished in the usual way, and the stock castings made from these.

Beloit, Wis. M. E. HOAG.

Making Small Grinding Wheels

On page 713, Volume 33, Mr. Godfrey tells about a certain foreman, making a small grinding wheel from a broken one. The time used in making the wheel does not indicate high-speed methods.

When working for a large railroad company, I had occasion to make small wheels out of broken pieces from larger ones, and, by experience know, that a wheel, ½x1½ inches, with a ⅜-inch hole, can be made in as short time as 10 minutes, without any greater wear on tools, than in dressing of a new wheel to desired size. The wheels were used for grinding the throat in thread-cutting dies.

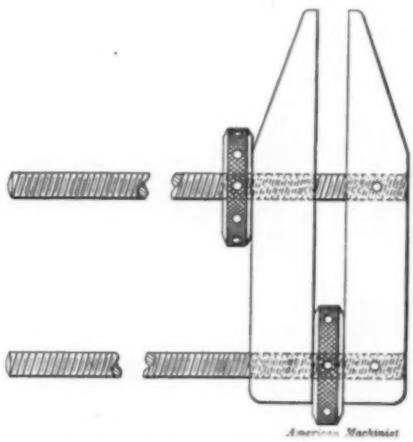
At the rate of 30 cents in an hour, the new wheel would cost 5 cents, which is a saving of 50 per cent., as compared with Mr. Richmond's statement, page 741, which goes to show that it is possible to make things as cheap as you can buy them.

Warren, Penn. G. WERNER.

Wide Range Toolmakers' Clamp

Much trouble is frequently experienced by toolmakers, working on jigs, fixtures and dies, in not having a clamp which has a range large enough to take in a variety of sizes.

The cut shows one, designed some



WIDE RANGE TOOLMAKER'S CLAMP

time ago by a fellow workman, which has filled a long felt want in our tool room and which will, no doubt, be appreciated by those having occasion to use a clamp having a longer range than the commercial article.

F. CHAS. SCRIBNER.

Greenfield, Mass.

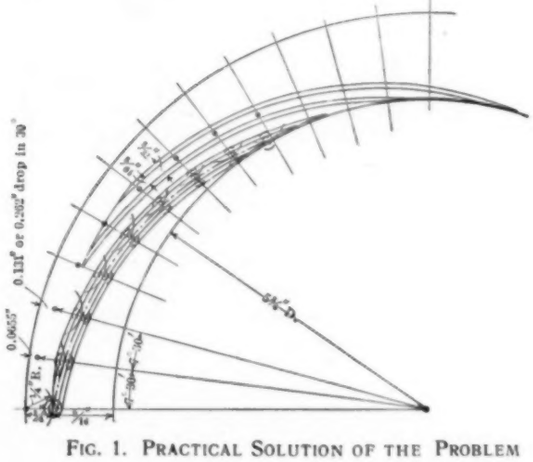


FIG. 1. PRACTICAL SOLUTION OF THE PROBLEM

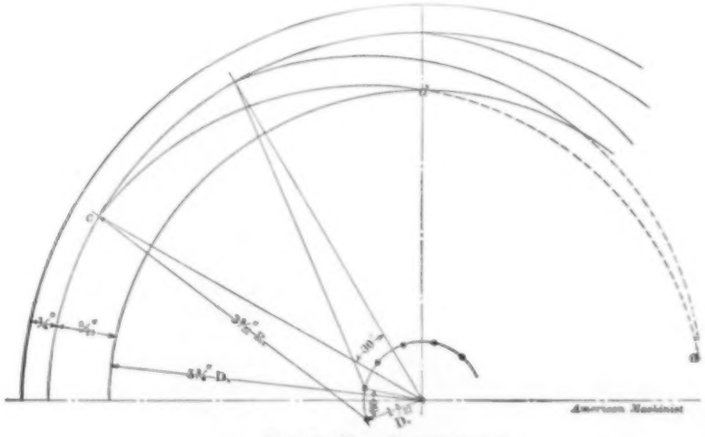


FIG. 2. THE FIRST LAYOUT

Measuring Angles with a Draftsmans' Scale

Laying off, or measuring angles with reasonable accuracy, is an operaiton generally supposed to require other tools than those most simple ones of a draftsman's equipment, namely, the triangles, compass and scale of equal parts. If an accurate protractor is not available, a table of natural functions is employed which, by the way, is better in point of accuracy than any other method. But it is evident enough that there is some advantage in securing the same result by a simple operation with the instruments constantly in use.

Both tables and protractor may be dispensed with by a simple application of a scale of equal parts to the classic construction for the rectification of circular arcs given by Rankine. These two constructions—the one for developing a given arc into a straight line, the other for finding the arc enveloped by a given line—are to be found in nearly every engineers' pocket book extant and readily will be recognized from the figures given for the measurement of angles in degrees.

As the process is most clearly exhibited by a numerical example, let it be required to lay off an angle of 20 degrees with the line $A\,B$, Fig. 1. Through B draw $B\,C$ making 60 degrees with $A\,B$, and $B\,E$ perpendicular to $A\,B$, at B. Make $B\,E = 3\frac{1}{4}$ inches in length, so that it embraces 60 divisions, each 1/16 inch. (This length may, of course, be made proportionally greater, if longer divisions are required for greater accuracy). With F as a center, distant 15/16 inch (one-fourth of $B\,E$) from B, describe the arc $E\,C$, cutting $B\,C$ at C. A line $C\,A$, at 60 degrees with $A\,B$, determines the point A, from which as a center, draw the arc $B\,M\,C$. For an angle of 20 degrees, take $B\,K = 20/16$, or $1\frac{1}{4}$ inches. From a point G, one-fourth of this distance, or 5/16 inch from B, as a center, describe the arc $K\,H$. The angle $H\,A\,B$ will be the angle required, and its error, barring the inevitable defects of manipulation, will, according to Rankine, be no greater than 1/935 of the arc. The dotted construction for 45 degrees constitutes a convenient test for the process.

The converse problem of finding the value of a given angle involves the second construction given by Rankine. Let $B\,A\,H$, Fig. 2, be the angle whose value is required. Through A draw $A\,C$ making 60 degrees with $A\,B$. With any convenient radius describe the arc $B\,H\,C$. Draw the chords $B\,C$ and $B\,H$ produced to $B\,C'$ and $B\,H'$. Make $B\,C' = \frac{1}{2}\ B\,C$ and $B\,H' = \frac{1}{2}\ B\,H$. Draw $B\,F$ perpendicular to $A\,B$ and, with C' as a center, describe the arc $C\,F$. Produce $A\,F$ until it cuts $E\,G$, drawn distant $3\frac{1}{4}$ inches from $A\,B$ and parallel to it, at E. Draw $E\,D$ perpendicular to $A\,B$ produced. The same construction applied to the arc $B\,H$ to be measured, determines the point M on $D\,E$. The distance $D\,M$ in sixteenths of an inch, is the value of the angle $B\,A\,H$, in degrees.

These methods are not presented by reason of any unusual simplicity; their value lies in involving constructions already well known, which can be executed with straight-edge and compass.

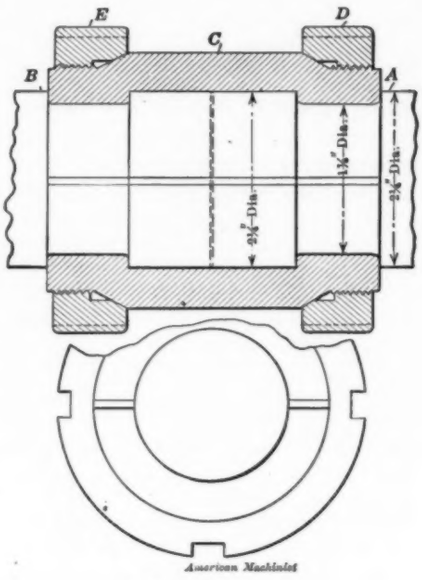
LUCIEN E. PICOLET.

Philadelphia, Penn.

A Rod Coupler

We recently had a job that called for a considerable number of cottered couplings, for connecting up pairs of $2\frac{1}{4}$-inch rods. These are generally expensive to make, as too many operations are required. These are boring and turning, milling and fitting the couplings, milling and fitting the cotter ways in the ends of the rods, milling the cotters, and ultimately fitting the whole together. Thus a suggestion was made that a substitute be presented for the cottered coupling.

The result was the coupling herewith shown in the line cut. It was a perfect



A ROD COUPLER

success, as it is far cheaper and better than the cottered coupling.

In the line cut A and B are $2\frac{1}{4}$-inch bright rods, and the strain is endwise. C is a malleable cast-iron sleeve, D and E are nuts of the same material.

The coupling was made complete in a hollow-mandrel lathe, with the exception that each had to be cut in two halves on the miller; an operation of about five minutes. The rods and the coupling steps were made to gages, and no trouble

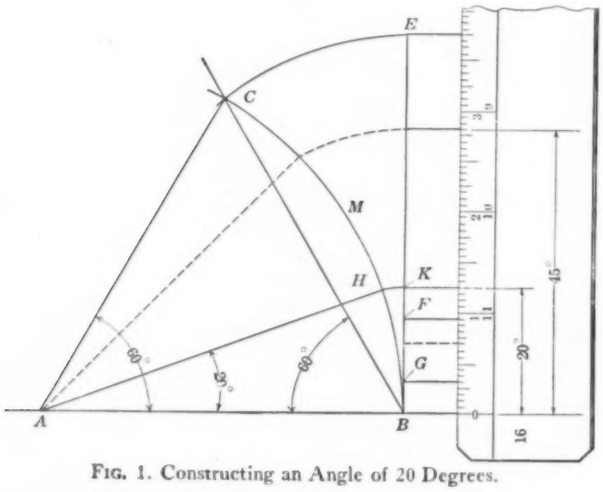


FIG. 1. Constructing an Angle of 20 Degrees.

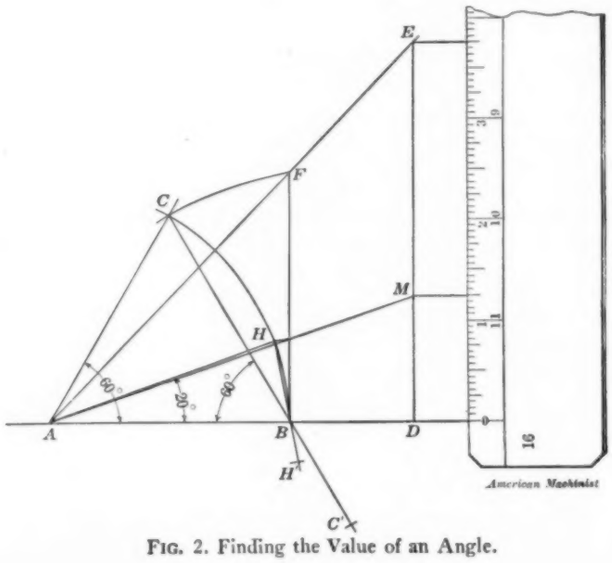


FIG. 2. Finding the Value of an Angle.

was experienced in getting the parts together. With five threads, or 10 to the inch, and the taper shoulders, a sound connection was made between the two rods, at about 25 per cent. of the cost which the cottered type demanded. The tightening slots in the nuts were cast in.

Silverton, Eng. J. TOWLSON.

A Plea for Clearer Drawings

The drawings produced in many drafting rooms resemble the trackings of a hen. We find them littered up with dimensions placed promiscuously about. Those offices which make all dimensions read in inches should use a system of putting the figures on the drawings similar to that used in European countries. There the metric system is practically universal and on nearly all mechanical drawings, the dimensions are in millimeters only.

Why cannot we use inches only, in this country, for mechanical work? Advocates of the metric system on this side

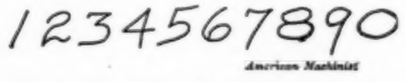


FIG. 1. UNMISTAKABLE NUMERALS FOR DRAWINGS

seem to have given up all hope of ever converting the manufacturers to its adoption, to the exclusion of the English system. Most automobile shops dimension all drawings to read in inches and they do not seem to have any trouble with their workmen because of this.

If the dimensions are made to read in inches we can well dispense with the inch mark. These do not enhance the beauty of any drawing. They require time to place on a drawing and, unless they are properly made, prove a disfigurement. Also, while we are at it, why not abolish the horizontal line in fractions; as ½? The oblique line was tabooed long ago, but it is occasionally found in some establishments. The plea will be made that confusion will result because a fraction, as 1 5/16, may be read 15/16 unless properly made. However, the drafting room of any plant is certainly the one place which contains no room for the man who cannot, or will not make things right. I am acquainted with one or two plants where this was abolished and, while at first there seemed to be a tendency on the part of some men to be a trifle careless in making their figures, it soon wore off after a few reprimands from the chief draftsman.

Another matter in which the European drafting room have it "on" us; that is, in the location of the decimal point. How often we see a dimension as 1.375, where the tail of the 3 nearly obliterates the decimal point. Why not raise the location of the point to about the center of the figures; as 1·375? This will tend to make decimals much plainer. I know of no objections that can be raised against this, unless it is prejudice.

While we are at it, why not establish a standard for numerals that are used to dimension a drawing? We hear people cussing because they mistook a six for a nine, or *vice versa*, or three for eight, or else some other figure for something else. Suppose we make our figures something like those shown in Fig. 1. The 3's and the 5's are similar to those found in logarithm tables, and everyone knows that it is easy to read the figures there, even in poor light. By making the 9 without any curled tail we help to simplify matters.

Another thing: Why not use a standard design of alphabet? In some offices we find each draftsman using his own style of letters. However, in the better organized offices we find the standard alphabet adopted, and each man is instructed to use that and no other. It makes for uniformity and clearness. We do not want a fancy letter, but the plain, gothic type, preferably slanted, as they are easier to make. Of course, for titles, etc., or where large type is desired, the block letter is, no doubt, the most fitting.

In dimensioning radii, why cannot we dimension them so that they may be read without turning the drawing around into

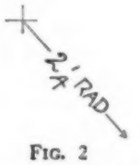


FIG. 2 Usual Method of Dimensioning a Radius.

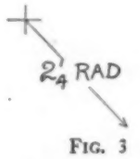


FIG. 3 Suggested Method of Dimensioning a Radius

several positions? For instance, instead of Fig. 2, why not do as in Fig. 3? Also, instead of placing the letter *R* after a dimension for radius, why not write *RAD*? I know of one case where a green workman spoiled several transmission cases because he thought *r* signified *ream!* Of course, this was a poor excuse for him to offer, but it goes to show the interpretation that is placed upon a dimension by some workmen.

The question of dimensioning keyways cut in a hub also arises occasionally. Some make it as in Fig. 4, meaning that they want the keyway cut in 3/16 inch from the top of the shaft; or possibly, 3/16 from where the dimension is actually made on the drawing. Why not make it as in Fig. 5? There would be no chance for misunderstanding by this method.

In dimensioning tapered parts, such as a lever, instead of placing a dimension at each end of the arm, why not use but one dimension line and make it read: Taper from ¾ to ⅜ inch? This cuts out one dimension line and gives the workman all his information at once, which the other method does not.

Many draftsmen will dimension a helical spring in such a way that no one really knows what they mean. For instance, how often do we see a note on a spring drawing to the effect that it is a 50-pound spring? Does it mean a spring exerting 50 pounds under a deflection of one inch, or at normal length, or at the deflection, which may be less than one inch? To this, no doubt, can be attributed a large part of the spring difficulties we hear so much about; mostly through the spring makers' inability to properly understand what is wanted.

Detroit, Mich. J. COAPMAN.

Fixture for Air Valve Plugs

Some time ago, I had to make about 500 air-valve plugs for hydraulic cylinders, as shown in Fig. 1. These plugs were made of hard gunmetal and it was necessary that the seating *C* should be in alinement with the threaded portion of plug to insure holding when closed against the high pressure.

As the job was not expected to come round again, the methods I adopted may interest others. They effected a considerable saving over the estimated time,

FIG. 4 Confusing Method of Dimensioning a Keyway.

FIG. 5 Suggested Method of Dimensioning a Keyway.
American Machinist

and were not costly nor difficult to make.

At Fig. 2 the plug is shown after the first operation; forming and threading in the turret lathe from cast bars about three feet long. We were not able to obtain rolled bars of sufficient hardness. I then made a mild steel chuck, as shown at Fig. 3, the end *G* being threaded for one-inch gas pipe, to suit flanges that we had for the lathe faceplates. It was bored out as shown, and the union *E* made and fitted in. This union also was bored and threaded to receive plugs which were inserted as shown, for the second operation of removing the end *H* and finishing the ball. A slight backward movement of *E* allowed the plug to be removed with the fingers.

Ball end of plug was then inserted in chuck *D*, and the seat *C* finished to the correct angle, as shown at Fig. 4. This also shows chuck *D* fixed to a small angle plate for the next operation; drilling the hole through ball to receive the pin *B*, Fig. 1, the hard-steel guide bush *F* be-

ing inserted after lathe operations were completed.

Pins *B* were cut from ¼-inch brass rod, the ends being rounded with a special countersink used in the centering machine while the plugs were held in the hand.

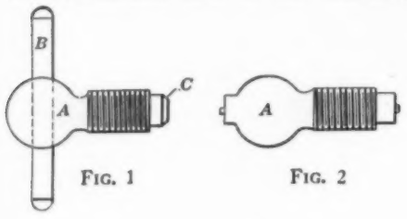


FIG. 1

FIG. 2

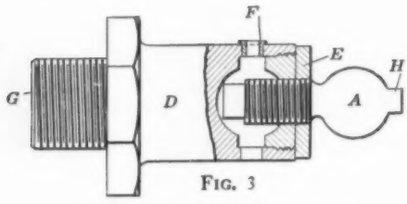


FIG. 3

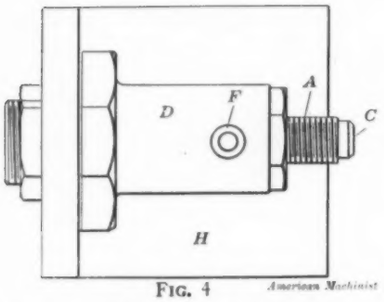


FIG. 4 American Machinist

FIXTURE FOR MACHINING AIR-VALVE PLUG

Belfast, Ireland. F. P. STRACHAN.

Machining the Jaws of Watch Crown Pliers

Fig. 1 shows one of the three pairs of pliers required to be adapted to clutch the watch-case crown, shown in Fig. 2. We took common 6-inch shop pliers and cut about 0.30 inch from the end of each jaw. The tools employed for the purpose are shown in Fig. 2. The forming tool was made of a piece of sheet steel 0.08 inch thick, drilled and reamed to size, then tempered and soldered on a bench-lathe tool stock. The curve was corrected with a diamond lap and no clearance was ground in the tool, this being obtained by inclining it. It was used for forming the circular mill which in outline was a close copy of the crown. One jaw of the pliers was gripped in a small bench-miller vise so that the other jaw was free to move. The circular mill was then fed down into the tight jaw to a stop. The other jaw was brought down on top of the mill, thus securing the required coincidence. To cut the notches corresponding to those of the crown the pliers were set up, as shown in Fig. 1. A screw similar to the one in Fig. 2 was driven through the face plate from the rear, allowing it to project about 0.40 inch. The mount was then screwed on this and in contact with the face plate. For locating the pliers the circular mill was placed in the tailstock spindle lightly, and moved up until the work could be adjusted to it, as shown by the dotted circle. After clamping the work a slight twist of the mill was sufficient to release it from the spindle when the tailstock was moved back. The angle mill was now set central with a center in the tailstock, then fed down to its work, and set to coincide with the curve in it. A trial cut was first taken, noting the number of thousandths on the graduations of the milling attachment. Indexing one notch as indicated, another cut of the same depth was taken, repeating this until brought up sharp. The remaining notches were then cut to the same depth. One-half only of the seat was notched and in appearance resembled the sketch in Fig. 2.

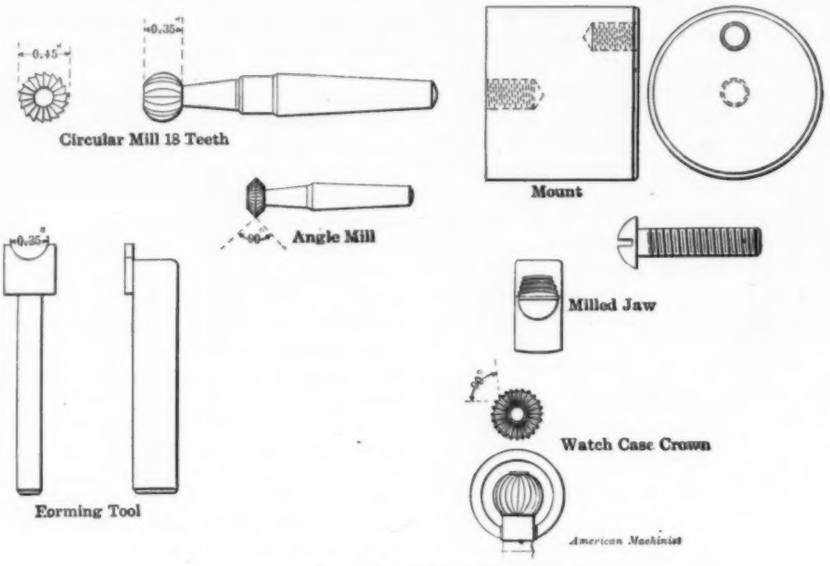


FIG. 2. THE WORK AND THE TOOLS

Elgin, Ill. GUS HAESSLER.

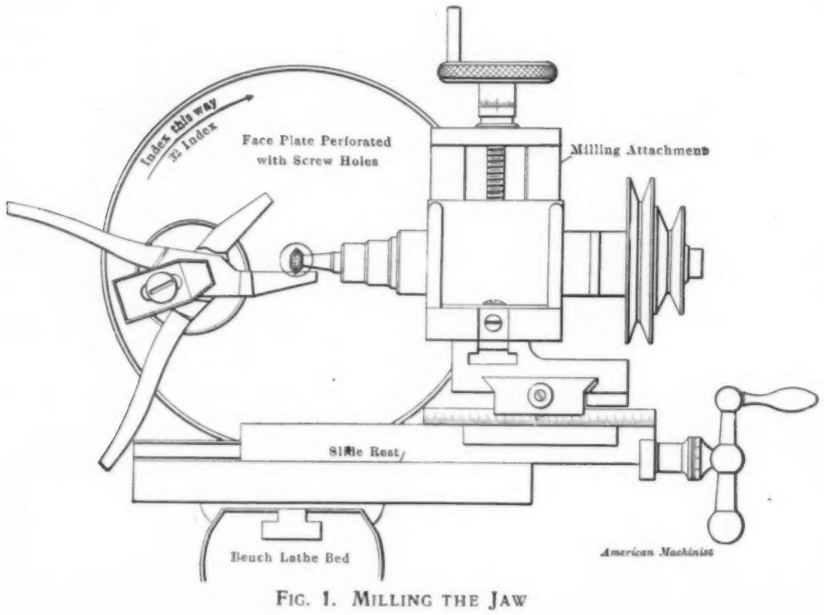


FIG. 1. MILLING THE JAW

There are a lot of notes and tables which are of almost daily use to the shop foreman and those under him, for instance, tapping sizes, letter and number drill sizes, etc. Handled by dirty hands these soon become so soiled that they cannot be read easily, if at all. It is but a slight improvement to varnish them. The best thing is not to handle them at all. This can easily be accomplished by placing them face up on the foreman's desk with a piece of plate or double thick glass on top. A small rim of wood should be nailed around the glass to keep it from sliding off. Where the lid of the desk is hinged the wooden border should have a small lip to hold the glass down upon it.

Discussion of Previous Question

More about Professors and Commercial Engineers

Letters from our readers showing how many men of many minds look upon various subjects opened up in previous numbers.

Our friend Entropy seems to have gotten himself into trouble by "stirring up the animals at so much per stir," even though he does profess the profession of Professor.

I have been greatly interested in the "Thermodynamical" licking he has just experienced, and wonder if he is now enjoying that "*much obliged*" feeling usually following a licking. At any rate, Professor Entropy is competent to speak for himself.

I believe Thermodynamics was out of his element in his "little journey into the world" and did not succeed there because of his fitness for teaching, which I really think unfits a man for competition in this cruel world, but, be that as it may, I most heartily disagree with him as to advancement in commercial engineering being greatly dependent on favor or pull.

As both Professor Entropy and Professor Thermo have given their personal experiences, I will give you some of my own, and what I have observed of others.

Another Personal Experience

At the outset I would remark that *I too* was honored by the offer of the "chair" of mechanical engineering in one of our Eastern colleges, but a thorough realization of my limitations in that direction prevented my acceptance, as I would undoubtedly have remained at the $2000 per year level, turning out students to fill those "$5000 jobs." I am not a professor, this much is certain.

Perhaps I am one of those whose salary, as Thermo states, "is proportional to those opportunities offered by our complex and artificial business and social system, enabling (me) to extract from others more than (my) rightful share of the wealth of the community." Whew! *This* idea of my earnings has never before entered my head, and I would much rather place myself in the category of those whose "services are worth more than the salary they receive," for it better accounts for the results I have attained, and is altogether more comfortable to my pride.

To begin with, after filling my mind with facts (and also principles) I started out to "show them a thing or two" and consequently wound up by obtaining a "*position*" mind you, not a "job" (jobs come high) as chauffeur of an *emery wheel* at a salary (?) of three dollars per week. My official duties consisted of bumping disagreeably shaped castings and other things up against a voracious emery wheel, the contour of whose periphery was a *wonder* and whose moral sense was entirely lacking, as it never hesitated to eat meat on Friday, or between meals for that matter, as long as I furnished the meat.

From this "poor but honest" beginning, in fact, as soon as the wheel was worn out, I gradually advanced through the machine shop, graduating from the tool room into the drafting room at a salary of $25 per week, all in a period of four years.

At the end of two years I was made chief draftsman at $2500 per year.

I next became engineer in charge of the department at $4000 per year and was next placed in charge of the design of a special line of machinery and given the business management of the new department—at *last* I had attained to one of those "$5000 jobs."

The broader acquaintance resulting from this position brought, in due time, an offer of $7500 per year, which I accepted, *of course*, and in two years this was increased to $10,000, which is the highest point I have reached, *as yet*.

So far I have had no "uncles" or "grandfathers" to help me along, and I saw no one go over my head during the entire period of my experience.

I attribute my progress to that and the other fact that I was profitable to my employers—they "needed me in their business."

Some Other Cases

As evidence that my experience is not abnormal, I will cite a few instances of engineers I have known whose careers have fallen under my own personal observation. I once took a raw genius out of the woods, who did not know the difference between a T-square and cube root, made him sweat blood over the drafting board for a year or so, then back he went to take $450 per month, and then, in two years his salary was increased to $750 per month, and later he accepted an offer of $15,000 per year, and will shortly receive $25,000—as the head engineer is pretty nearly dead now.

Another draftsman whom I had at $20 per week is now chief engineer for a large machinery company under a ten-year contract at a salary of $7500 per year.

Still another, a clerk, came to me and I put him over the route, and he is now chief engineer of a company that pays him $6500 per year. So it goes.

I do not feel that I am to blame for the success of these fellows, but I do feel that it is due to their natural ability.

One young man came to me who had resigned his position as professor of mechanical engineering in one of the State universities, in order to earn a decent living. I gave him a job as draftsman, and when the opportunity came he fastened to it, and is now a prominent consulting engineer, earning about $20,000 per year.

It seems to me that it takes both the professor and his output to meet the demands of our "complex and artificial business and social system." The faculty for successful teaching is *born* not *made*, as is also the judgment required for successful practical engineering.

I am thoroughly of the opinion that an engineer cannot succeed in commercial lines unless he has the courage of his convictions and a proper disregard for precedent, coupled with the faculty of getting the last bit of efficiency from each particular "emery wheel" before him.

Salaries are not paid on the *job* but to the man, and the measure of the man is the amount he can *command*, for he makes his own job, in whatever position he is placed.

Perhaps, after all, the same reason holds good why professors do not go after and obtain those "$5000 jobs" that prevented me from getting that $15,000 position I have just alluded to; namely, the opportunity came to the other fellow and not to me, and, I have an uncomfortable suspicion that there is a *bare possibility* that he was better fitted for the position than I am.

Now about those "$5000 jobs"—I am inclined to think they are like dead mules, for you never see dead mules lying around, and I have never seen $5000 jobs lying around either, uncovered for any length of time.

Success in engineering is not like "kissing," because that does "go by favor" but it depends on merit alone and the salary paid pretty nearly represents the worth of such service, *minus the legitimate profit* of the employer.

Los Angeles, Cal. L. C. Faust.

Drilling Index Plates on Gear Cutter

Reading your recent article on page 677, describing a method of drilling milling-machine index plates on a Whiton gear cutter, brings to mind a fixture for performing this same operation, which was used in a plant where I was formerly employed. It has the advantage of being entirely automatic in action, and no additional countershaft or belts were required.

This fixture was made to be used on a No. 3 Brown & Sharpe automatic gear cutter, and with care in its construction does first-class work. A cast-iron housing was made, fitted with a small horizontal drill spindle, at right angles to the regular cutter arbor and about three inches above it.

This housing was bored, planed and scraped to fit in place of the regular dovetailed outer bearing supporting the cutter arbor, and held in place by the regular clamping device.

In place of the cutter, a spiral gear was mounted upon the cutter arbor, meshing with a smaller gear attached to the drill spindle when the fixture was slid into place, thus increasing the speed of the drill spindle and changing the axis of rotation to conform with the direction of feed of the cutter slide.

In operation, a blank plate was placed on an expanding arbor held in the regular work spindle, and indexed for the required number of holes.

The cutter arbor was speeded as high as possible, the feed cut down, the first hole located and drilled, using as short a drill as possible; the regular trip dogs adjusted and the machine left to itself until the first row of holes were completed. Then another plate was placed in position and the operation repeated, until all the blanks were drilled. The head was then lowered and indexed for the second row of holes, and so on, until the whole lot was finished.

We found that, by using a very short drill and carefully fitting the drill spindle, a guide bushing was unnecessary, but it could be applied easily, if desired.

Jamestown, N. Y. H. L. VAWTER.

Professor's Work and Some Further Reflections

Thermodynamics' view of the work of the professor, written for the sake of "lickin'" Entropy, has been read by the latter in that spirit of contrition that is always found in the "licked." I happened to open the paper at page 728 where he tells of his hours of work. I was on the point of writing to the editor of the AMERICAN MACHINIST to get in communication with him until I saw the next paragraph where he alleges a state of favoritism in the commercial world that matched my feelings toward the college world. We need another instructor here very soon and I am looking for a man of broad liberal education, who has forgotten the proper amount of said broad education so that he can get down to brass tacks on some mighty practical work. He must prove that he is not a member, either honorary or otherwise, of the Professor's Union. *But,* he must have shown some ability to command wages or salary in the commercial field.

I agree heartily with the editor that no sensible man does other than respect the teacher's calling and the true teacher. I have, however, met either as student or fellow teacher a considerable number of men who posed as teachers and who held chairs as professors who were not true teachers. They had gone through a course of training intended to fit them for such occupations but had never found the true spirit of the profession. On the other hand I have met in a lifetime possibly six men who had absolutely no training for teaching who taught and taught successfully and who have hundreds of friends scattered the world over who were once their boys. Against such as these I have no word to say.

But, seriously I do believe that when the time comes for a cleaning up of the colleges, and notably the technical colleges of the country, as bad a condition of things will be found as has been found in numerous other matters where power without responsibility has been conferred on men.

The matter of whether Entropy is a good teacher or a "bum" one has little to do with the case and probably is something on which different persons would disagree, and so also is the matter of whether Thermodynamics is a success in commercial lines. I doubt if I should feel safe in engaging a teacher who has found commercial life so full of favoritism.

EMPLOYERS ALWAYS LOOKING FOR MEN

No! Thermodynamics, you are dead wrong. Employers are looking for the dollars so closely that they cannot afford to think whether they are hiring relatives or not. Most employers would rather pension a relative than hire him anyway. Of course, there are employers who are on the downhill side of business who are simply struggling against the tide, but every business that is going in with the tide is watching out for young men who can make good. If anything advancement in this country is too rapid for the permanent good of business. I could tell Thermodynamics of a hundred men right within two miles who have worked their way up to the top of their respective concerns without an uncle or an aunt to aid them, and they did not stick long at the 50-cent job. Where Thermodynamics gets his figures I do not know, but 95 per cent. of the concerns that I have had the fortune to know anything about have their eyes out sharp for any man, no matter where he is in their employ, whose head sticks up over an inch above his fellows. Just here is where many young men make their mistake. They think that being better than their fellows means getting out more work. That alone does not distinguish a man in the minds of his employer. In fact it may be a very good reason for not advancing him, but let a man show signs of initiative or executive ability and his employer will spot him in a minute. The places in the commercial world that are worth while are the places where a man must do things—not one operation after another, any automaton can do that, but do something new and do it right and when it ought to be done. I have more gray hairs than a man of my age ought to have simply from wondering whether the man out in the shop would do what I had told him or whether when he found things going wrong he would think for himself. A man has to take his job in his hands at least once a month to hold a $1500 job and once a week to hold a $2500 job, and so on up. Most of the big men in the commercial world keep their resignations all written and handy in the corner of their desks—and never use them. Any man can talk about how much he knows but when a man stakes his job on what he can do and wins, he commands the attention and respect of every man who is staking his capital on the commercial game.

Springfield, Mass. ENTROPY.

Cause of Electric Shocks

It frequently happens in the machine shop that unpleasant electric shocks are received from some part of the electrical equipment or other metallic fixtures or perhaps even parts of machine tools. It is sometimes supposed that this shock indicates an electrical leakage or ground from some part of the apparatus. This supposition is usually unfounded, and in all probability the cause of the trouble can be traced to the generation of static electricity by moving belts. Many times very painful shocks are received, due entirely to this cause. A remedy is to ground the frames of all electrical apparatus and to ground all rapidly moving belts of any size, making use of a brush collector composed of a series of wire points placed a short distance from the moving belt. These points need not and better not come in contact with the belt system as the static electricity will jump across a short intervening air gap. These brushes can be grounded to a water pipe, on the metal frame of the building.

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American Machinist

Editorial

Two Machines per Man, or Two Men per Machine?

The constant increase in the percentage of the overhead charge in machine-shop administration, and, especially, the growing complexity and consequent cost of machine tools, is bringing about a radical change in the viewpoint of economical production, especially as relates to the operation of more than one machine by a single operator.

In former days the chief item of cost was the wages paid for direct or so called "productive" labor. Under these conditions the search for reduced cost led inevitably toward the operation of as many machines as possible by one operator, since that procedure led to an increase of production per dollar of wages paid.

When, however, the expense item increased until it surpassed, as in most cases today we believe it does surpass, the wages item, and, especially, when the direct cost of the equipment per man increased to its present figures, the situation arrived when we must reopen the subject and contrast the largest production per dollar of investment with the largest production per dollar of wages.

The two viewpoints are antagonistic because, in most cases, the operation of two machines by one man, while leading to an increased output per dollar of wages, leads to a reduced output per dollar of investment. The leading, and perhaps the only, exception to this rule lies in the case of fully automatic machines.

It is this increased cost of the equipment which has been, at bottom, the reason for the present universal movement toward intensive production through premium, bonus, routing, time study and other systems, and its tendency is not only toward restricting each operator to a single machine, but, in some cases, to providing this operator with a helper in order that the lost time between cutting operations may be reduced.

Our attention has been directed to the subject anew by a knowledge of a practice of one of our machine-tool builders, whose name is known to all readers of the AMERICAN MACHINIST, and who is frequently called upon to guarantee the output of his machines. It has become his regular practice in such cases to guarantee one output if the operator has no helper, and another output if such a helper is provided, the output guaranteed under the second condition sometimes exceeding that guaranteed under the first by 60 or 70 per cent. With this second guarantee there frequently goes a requirement for a duplicate equipment as regards mandrels or other chucking devices, in order that the helper may do all of the preparatory work for the pieces except the mere placing of them in the machine.

The value of the helper depends, of course, largely upon the complexity of the chucking operation and the consequent idle time which would be consumed by the operator if he performed the chucking operation, but which is saved by the assistant.

We can do no more here than point out a general principle, and to note that it brings about another condition favorable to the manufacturer who makes a study of fundamental conditions. The factor of wages will not permit itself to be overlooked, while the factor of expense is easily lost sight of. Nothing is so easy as to add to the real cost of production by ignoring what has become its largest item, and devoting one's attention to the item which, while of less importance, is more conspicuous.

The American Opportunity in Industrial Education

The more the conditions that surround industrial education in Germany are sized up, and the better acquainted with actual German practice we get, the more does the feeling grow upon us that the fundamental conditions which exist here are favorable to a far greater development than anything that Germany can show.

Referring always to elementary education intended for those who are to earn their livings with their hands, we are beginning to learn that Germany, instead of doing much, in reality does but little, when measured by what is done for each individual. The aggregate is great because the number to be dealt with is great; but the benefit to each individual cannot be large, and in saying this we are not forgetting that Americans are not in a position to criticize, because, little as Germany does, our own country does much less.

The continuation schools of which we have heard so much, comprise all of the educational opportunities which the German system places before the apprentice who is to become a manual worker.

While the practice varies in different

sections of the country, especially as regards evening school work, the fact remains that the system consists, in general, of from four to six hours per week of evening school work during the two years from 14 to 16 years of age, the work being shop mathematics, drawing and German. The boys who take this work are apprentices, who come to the school after a full day of work in the factories, because as we have already pointed out, apprenticeship in Germany customarily begins at the age of 14. In the nature of things, many of these boys are unwilling, some are rebellious, and all are tired.

The schools are little more than an attempt to do what is possible for those who are compelled through the pressure of economic necessity to enter the factories at an unduly early age. In this light we have no criticism to offer, but it seems to us quite clear that the industrial value of such work is quite limited and of far less importance than we have been given to understand. The time is too short, the boys are too young and the work is too general.

The fundamental condition which makes greater resuits possible here grows out of the fact that the factories will not take boys as apprentices until the age of 16. This condition which, in the past, has led to the lamented two years of lost time, has enormous possibilities of usefulness. With even one of these two years utilized as at Fitchburg in school work and with three years more given to school and shop work on the half-and-half division which there prevails, it must be obvious that results can be obtained, alongside of which those due to the German continuation schools will look small.

So far the campaign for industrial education in this country has been largely a case of the blind leading the blind; but light is beginning to break through. Fundamental conditions are highly favorable; tangible and practicable plans have been developed and are in operation. There is no reason why all and more than has been predicted by enthusiasts in the movement should not be realized.

The Opening of the American Museum of Safety

The formal exercises in connection with the permanent exposition of safety devices of the American Museum of Safety were held on the evening of November 21, at the auditorium of the Engineering Societies' building, New York, Philip T. Hodge presiding. The Museum of Safety is the fourteenth similar organization; of which there are 12 in Europe and one in Canada. The object of the museum is the conservation of human life, by means of a permanent exhibit of the best and most practicable safety devices for making safe the dangerous parts of machines and processes. It is a clearing house for the prevention of accidents, 50 per cent. of which are claimed to be unnecessary.

The director of the museum, W. H. Tolman, who spent the summer in Germany studying their system of accident prevention, showed, by means of lantern slides, how the Fatherland is saving 50 per cent. of the accidents to labor. In the last 25 years Germany has spent upward of 2½ billion dollars in preventing accidents, restoring the wage-earning efficiency to the sick and wounded workmen, and in compensation to their families.

The views of the magnificent buildings and equipment of the various German museums show what our museum, with its single room only partly filled with exhibits, may yet attain.

PERSONALS*

C. B. Kirkham, formerly secretary and general manager of the Kirkham Motor Manufacturing Company, Bath, N. Y., has resigned his position.

Charles P. Smith, mechanical engineer with the General Electric Company, at Lynn, Mass., has resigned in order to become master mechanic of the Pacific Mills, Lawrence, Mass.

Thurlow E. Coon, who was formerly manager of the Ball Engine Company's Detroit office, has severed that connection in order to assume partnership in Coon-De Visser Company, Detroit, Mich.

William T. English, who has been president of English & Flett, Boston, Mass., retains a similar position in the newly organized company of Walworth-English-Flett Company, of the same city.

Arthur T. Doud, mechanical engineer with the Hale-Kilbourn Metal Company, Philadelphia, has resigned, in order to become general superintendent of the Speakman Supply and Pipe Company, Wilmington, Del.

Kenneth B. Millet, until recently factory superintendent of the Protal Company, Bridgeport, Conn., has accepted a position as mechanical engineer with the Newburgh Ice Machine and Engine Company, Newburgh, N. Y.

T. W. Holloway, who has been abroad for more than a year assisting in the preparation of textbooks for the English company of the International Correspondence Schools, has returned to headquarters in Scranton and will act in an editorial capacity.

George D. Hartley, who has been connected with the Mergenthaler Linotype Company for several years, has resigned in order to undertake the commercial development of the Sigurdsson type-casting and composing machine with the Oddur Manufacturing Company, New York City.

John I. Rogers, who was formerly with the Midvale Steel Company, and who has been conducting a consulting engineer's practice for the past year, has established his headquarters at 165 Broadway, New York City. Mr. Rogers is specializing in machine shops and power plants and in general iron and steel work engineering.

W. J. Radcliffe, who has been in charge of the machinery department of E. A. Kinsey & Co., Cincinnati, Ohio, for a number of years, has been made secretary and general manager. The change was due to the recent death of A. P. Gahr, president and general manager, whose brother, W. H. Gahr, has been named as vice-president.

Prof. John Braschear, noted scientist and astronomer, has just been informed that the Elliott-Cresson gold medal and prize this year has been awarded him by the Franklin Institute of Philadelphia, as a reward for his scientific research in the last few years. Professor Braschear is the second Pennsylvanian to receive this high honor from the establishment founded by Benjamin Franklin. The other Keystone State scientist was John Fritz, of New Bethlehem.

*Items for this column are solicited.

David Hunt, Jr.

The untimely death of David Hunt, Jr., so well known in the machine-tool industry, will be a matter of deep regret to the many friends he had made during his short and successful career.

His death was the result of an accident on the night of November 26, near Yale, Mich. It is reported that he was riding on the hood of an automobile, acting as lookout along a dark road, when the front wheels of the car ran into a culvert, overturning the car, under which he was crushed and sustained injuries from which he almost immediately died. Two associates in the car escaped with slight bruises and a shaking up.

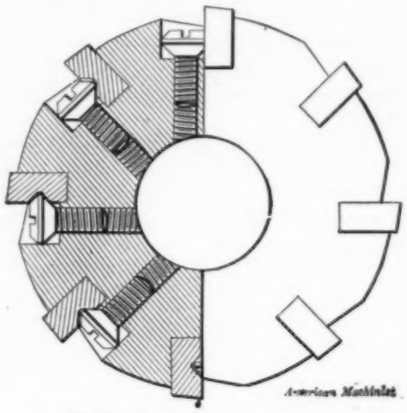
Mr. Hunt first became known in the machine-tool field while acting as secretary of the Baush Machine Tool Company, in which capacity he remained for several years. His next position was that of local manager of Manning, Maxwell & Moore's Cleveland office, subsequent to which he became sales manager of the Warner & Swasey Company, Cleveland, Ohio. Mr. Hunt held this position several years, and relinquished it only a few months ago in order to accept the position of manufacturing manager of the E. M. F. Company.

Mr. Hunt was about 40 years of age and is survived by his wife and one child.

New Tools and Shop Appliances

A New Adjustable Reamer

The Standard Tool Company, Cleveland, Ohio, has put on the market a new adjustable reamer known by the trade name "Stana R."



A New Adjustable Reamer

The body is made of machinery steel. The blades are unevenly spaced insuring a smooth hole. The blades are held in place by heavy screws with special shaped heads which engage the V-slots on the side of the blades as shown in the line cut. The blades can be readily removed, packed out and reground to size.

A Trolley Wheel Turning Lathe

The halftones show a Garvin No. 3 screw machine, built by the Garvin Machine Company, New York, and specially equipped for the rapid production of trolley wheels used in electric railways. Two tools are mounted on the cross slide. Each of these finished one-half the groove in the wheel. The saddle carrying the forming tool slides is, in this machine, not rigidly fixed to the bed but has limited movement along it by means of a rack and pinion operated by the lever to the left and below the pilot wheel. The addition of this feature was made necessary because of the nature of the work to be handled.

The material from which these trolley wheels are made varies from practically pure copper to very hard bronze. The scale on these is very hard and it was found that even the hardest of high-speed steel tools would dull rapidly if fed straight into the work slowly by means of the cross feed. By this arrangement the tools can be fed nearly to the bottom of the groove without touching the metal and a sudden slight movement of the saddle to right or left brings the cutting edge beneath the hard surface. The machine is equipped with the Garvin pneumatically operated chuck which instantly grips or releases the work.

ANY and all new or improved machines, tools, or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here—the machine shop news.

A more full and detailed description will be given—when it is real news—if it can appear here first—before it is sent to other papers. All descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.

The work is gripped in the chuck and a rotating steady, mounted in the turret, is brought up against the outboard face, relieving the chuck of considerable strain. The first operation is to finish the groove, after which the turret is run back and the hole is drilled, bored and reamed by successive tools held in the turret. With this machine a hard-bronze wheel 4 inches diameter, 1½ inches wide, with a groove ¾ inch deep and having a ⅞-inch hole through it, can be finished in two minutes. By substituting other jaws

Fig. 2. The Finished Wheel and Forming Tools

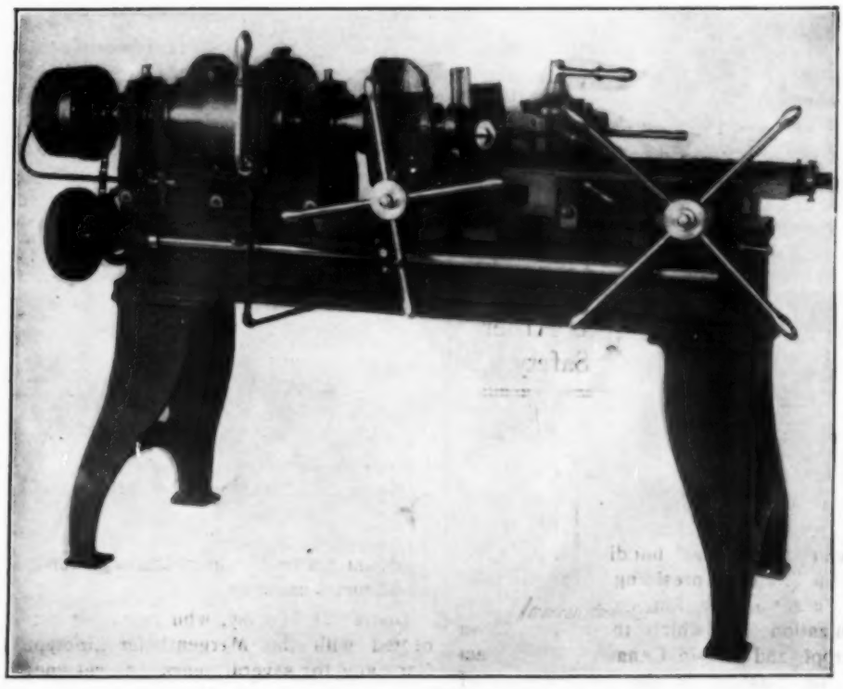


Fig. 1. A Trolley-wheel Turning Lathe

for the chuck, this machine will bore and finish the holes in the yoke which carries the wheel.

An Ellipsograph

The halftone shows an ellipsograph manufactured by J. T. Kelley, West Rush,

AN ELLIPSOGRAPH

N. Y. With it ellipses with various major and minor axes, within a wide range, can readily be drawn. The compass member can be detached from the ellipsograph and used as ordinary compasses or dividers, an extra leg for that purpose being supplied with the tool.

Weaver's Roller Jaw Chuck

The line cuts show the construction of this chuck, which is made by Weaver's Roller Jaw Chuck Company, Springfield, Illinois.

Fig. 1 shows the manner in which the steel roller jaws, Fig. 4, engage the shank of the drill and automatically increase their hold or "grip" as the resistance of the drill increases. It is a cross section of the chuck and drill shank.

The outer rim is the heavy one-piece body of the chuck (shown in Fig. 3), and shows clearly the three cam faces, comprising the inner wall of the body, upon which the rolls operate.

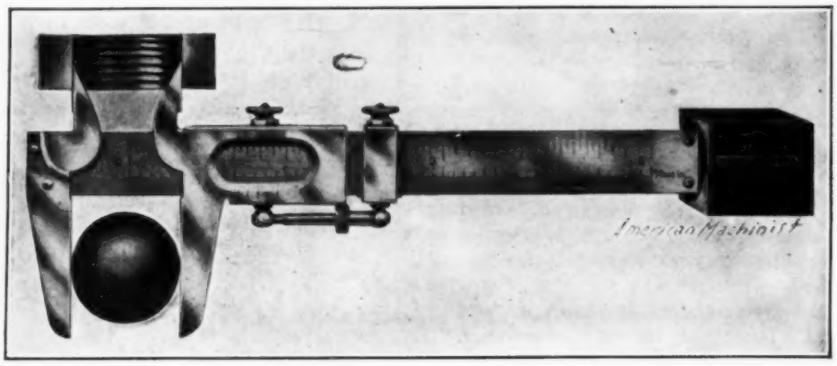
In the center is the shank of the drill as engaged by the roller jaws, which are represented by the three circles surrounding it.

With the polished roller jaws brought into very light contact with the shank of the drill, by means of the cage, Fig. 2, the grip of the jaws upon the shank tightens automatically as the resistance of the drill increases. This is occasioned by the constant tendency of the drill to force the rolls further up the faces of the cams.

A Vernier Caliper and Depth Gage

The halftone shows a very handy combination tool which is being put on the market by Schuchardt & Schütte, 90 West street, New York.

When setting the jaws for outside measurements the inside jaws and depth gage are simultaneously set to the same measurement without any allowance plus or minus as is the case when but one pair of jaws provide for both male and female measurements. The tool is graduated on one edge in sixteenths and on the other edge to fiftieths of an inch. By means of the verniers the upper scale reads to 1/128 inch and the lower scale to 0.001. The tool is supplied either with or without the micrometer adjusting screw shown, polished or nickel-plated finish and is packed in a neat leather case.



A VERNIER CALIPER AND DEPTH GAGE

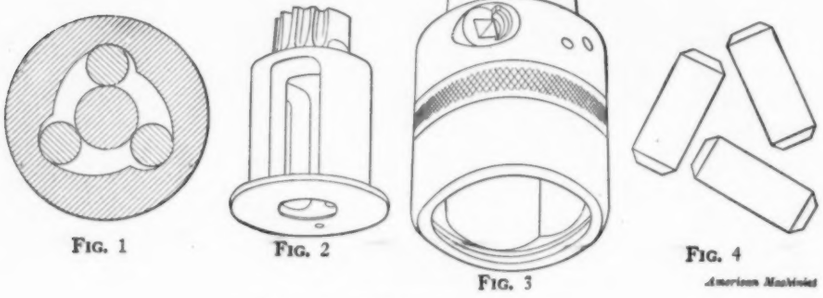


FIG. 1 FIG. 2 FIG. 3 FIG. 4

WEAVER'S ROLLER JAW CHUCK

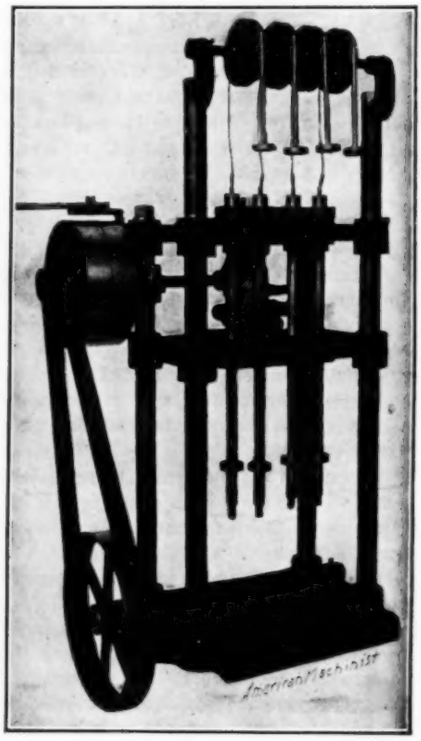
A Poppet Valve Grinder

The halftone shows a new type of machine for mechanically grinding poppet valves in gas-engine cylinders, especially adapted to automobile-engine cylinders and recently patented by J. F. Higbee, of Muncie, Indiana.

The principal feature of the machine consists of a compound ratchet movement which is very durable and gives an exact duplication of the hand action, viz., a progressive reciprocative movement, and at the same time automatically lifting the valve in order that new grit may enter the portion of the valve to be ground.

This machine not only produces a better class of work than the average work done by hand, but will grind from four to eight valves every 10 to 12 minutes, with the aid of one man.

In operation the cylinder castings are

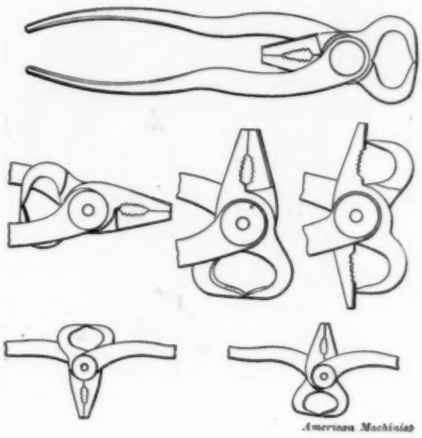


A POPPET-VALVE GRINDER

placed on the base, the valves to be ground are connected to the spindles and the machine is started up.

Combination Pliers

The line cuts show a combination tool made by the Medhus-Pihl Company, Hastings, Mich. The jaws have a square recess which fits a square projection on the handles. This gives four positions in



COMBINATION PLIERS

which the jaw can be placed with relation to the handle. Other jaws, not shown, are made, and all the parts are interchangeable. The tool has the appearance of being a trifle better than the average combination tool.

15-inch Toolmakers' Lathe

The engravings illustrate the 15-inch toolmaker's lathe with quick-change gear box, built by the John B. Morris Machine Tool Company, Cincinnati, Ohio.

Front and end views are shown in Figs. 1 and 2 respectively; and the general proportions of the tool, the form of the ways for head, tailstock and carriage, as well as other important features of design, are brought out clearly. The headstock is long and of rigid construction, and, it will be seen, is so designed as to inclose entirely the face gear. Gear guards are provided for the back gears. The reverse plate is mounted at the outside of the headstock, thus avoiding the coring out of the web to provide space for this member. The spindle runs in solid bronze boxes and its bearings are provided with ring oilers. There is a 1⅜-inch hole through the spindle and the latter is adapted to receive the spring collets, draw-in tube and closer shown in Fig. 3, the set of collets ranging by sixteenths from ⅛ to 15/16 diameter. The nose of the spindle is 2½ inches in diameter and serves as a pilot for the face- or checkplates which screw direct into the face gear. The front spindle bearing is 2⅝ inches in diameter and 4 inches long. The cone has three steps for a 3-inch belt and is double back geared in the ratios of 4 to 1 and 16 to 1.

The tailstock can be securely locked to the bed by a single lever; it has a graduated set-over and can be extended over the end of the bed for long work. The apron is double-webbed and all shafts which are subject to severe strains are provided with double supports. The rack pinion is adjustable to compensate for wear. The chasing lever below the apron is used for roughing threads with the ordinary rack feed to preserve the lead screw for finishing. Provision is made for preventing rack and screw feeds from being engaged at the same time. The quick-

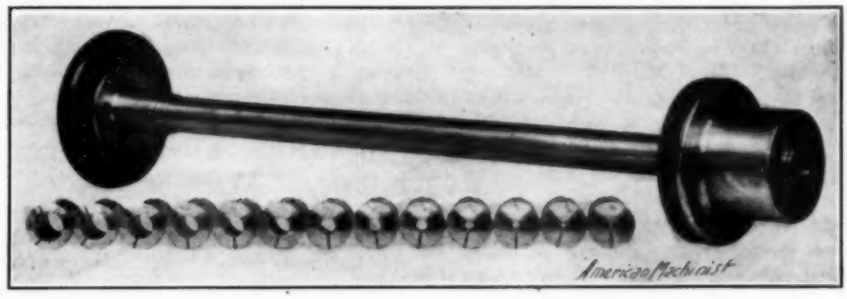


FIG. 3. SPRING COLLETS AND DRAW-IN DEVICE

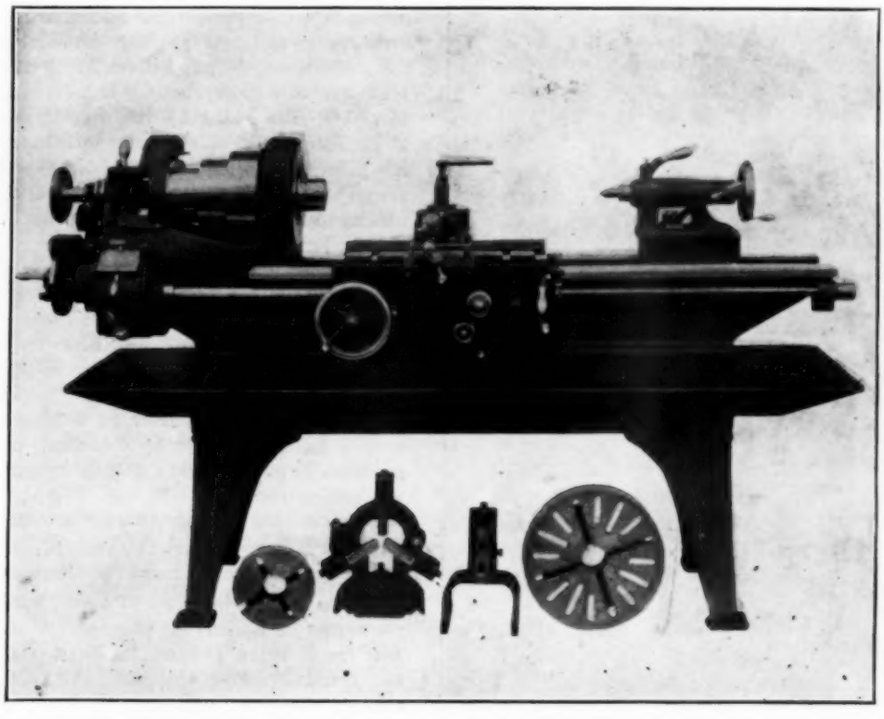


FIG. 1. 15-INCH TOOLMAKER'S LATHE

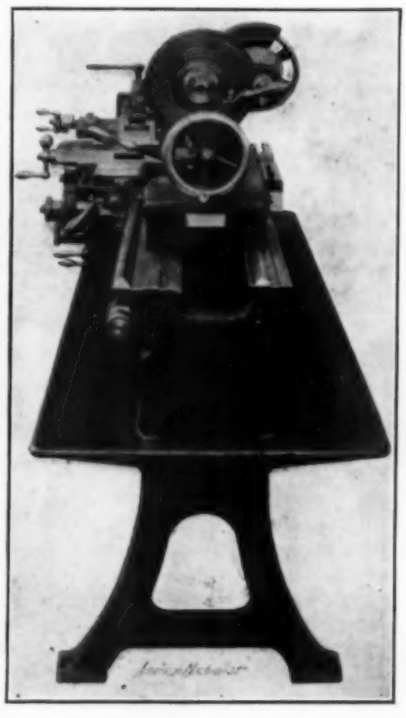


FIG. 2. END VIEW OF TOOLMAKER'S LATHE

change gear box is arranged for feeds for turning or for screw cutting from 4 to 256 per inch. A chasing dial is provided for catching threads so that threads can be cut without stopping the lathe or reversing the lead screw.

The lathe is regularly equipped with a compound rest which has a long traverse and is accurately graduated throughout the entire circle. The lathe is also built with semi-quick-change gear box which gives three rates of feed for every change of gears, these feeds being obtained instantly by moving a lever. The threads cut with this form of gear box range from 2 to 72 per inch, including 11½ pipe thread, while the turning feeds range from 0.003 to 0.5 inch per revolution of spindle.

The lathe swings 15⅜ inches over the ways and 10½ inches over the carriage. With the standard 6-foot bed it turns 3 feet 4 inches between centers with the tailstock flush, and 5 inches more with the tailstock overhung. The countershaft has double-friction pulleys 12 inches in diameter and both belts may run forward as no backing belt is required. The countershaft speeds are 200 and 252 revolutions per minute. The weight of the lathe is 1600 pounds.

Double Spindle Milling Machine

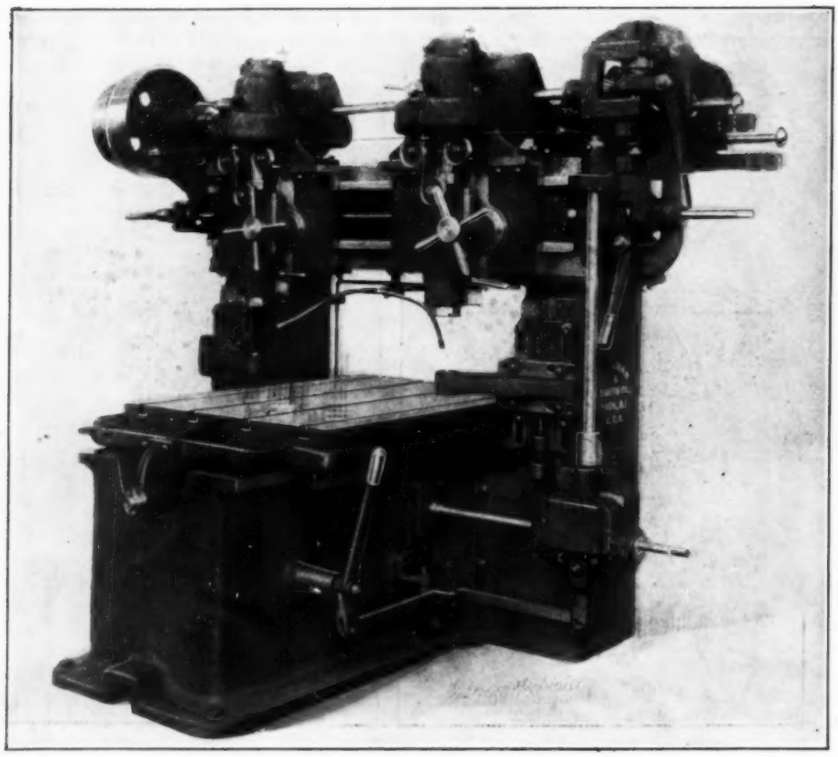
The illustration shows a double vertical-spindle milling machine recently built by Beaman & Smith, Providence, R. I., Each spindle is provided with a support for the lower end of the milling cutter, these supports being adjustable through quite a large working range.

The table is 36x48 inches with a travel of 52 inches, while the housings are 46 inches apart.

The spindles can be adjusted from 24 to 40 inches center distances, to suit the work while the vertical adjustment is from 3 to 9 inches above the table. The spindle is 3¼ inches in diameter at the front end.

The gearing ratio from core to spindle can be varied from 3:1 to 10:1, right spindle speeds being available with a two-speed countershaft.

The two pull levers at the upper right hand give 9 feed changes, the numbers being a direct guide to the proper setting of the feeds.



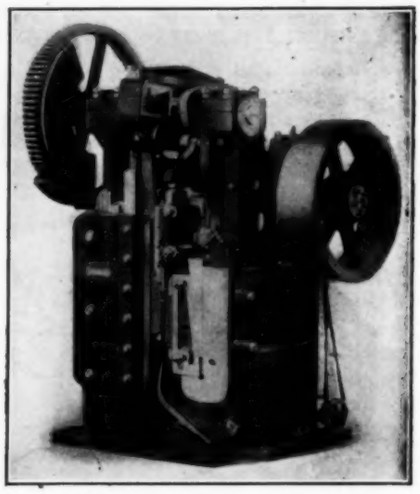
VERTICAL DOUBLE-SPINDLE MILLING MACHINE

A Vertical Thread Rolling Machine

The halftone shows the new National vertical roll thread machine manufactured by the National Machinery Company, Tiffin, Ohio.

In this type of machine long rods can be threaded as well as bolts. The blanks are fed into the dies horizontally, enabling work of any length to be handled, and the ability to thoroughly flood dies having their grooves in a vertical plane insures the lubricant thoroughly cleansing the thread, resulting in greatly increased die life. The reciprocating die slide is operated by a Scotch yoke. The yoke movement gives a slow downward stroke and a quick return. The slide is backed by a train of hardened-steel rollers, actuated by racks and pinion. This roller bearing reduces friction and wear and the power required for operating the slide.

The stationary die box is provided with wedge adjustments at the back and side which are easily accessible from the front of the machine. This wedge construction permits the most minute adjustments to be secured.



A VERTICAL THREAD-ROLLING MACHINE

In feeding, the blank is inserted into the gap between the dies, against a suitable gage; the blank lying upon a rest, or feed bar. The starter, actuated by a cam on the main shaft, introduces the blank between the dies at the proper time, and the rest, or feed bar, automatically backs out of the dies, and returns to its original position to receive the next blank. The movement of the feed bar is parallel to the face of the dies, and this aided by the starter, always insures the blank being introduced into the dies correctly. The rest and starter are both adjustable for handling various diameters within the capacity of the machine.

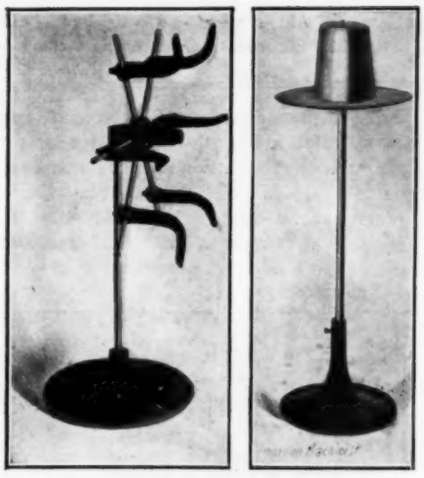
A friction slip flywheel is employed which acts as a safety relief to the machine.

The machine is built in three sizes with maximum capacities for rolling threads 1 inch diameter by 3 inches in length, ½ inch diameter by 4 inches, and 2 inches diameter by 4 inches. Intermediate diameters to 6-inch lengths can also be rolled.

Sheet Metal and Wire Reels

The halftones show two of a very complete line of adjustable sheet-metal and wire reels being put on the market by the Baird Machine Company, Oakville, Conn.

These reels are used in connection with standard and automatic wire-forming



SHEET METAL AND WIRE REELS

machines and punch presses. The reels used in connection with presses are for the convenient handling of strip stock and for automatically winding up the scrap as it comes from the press.

A Duplex Rod Boring Machine

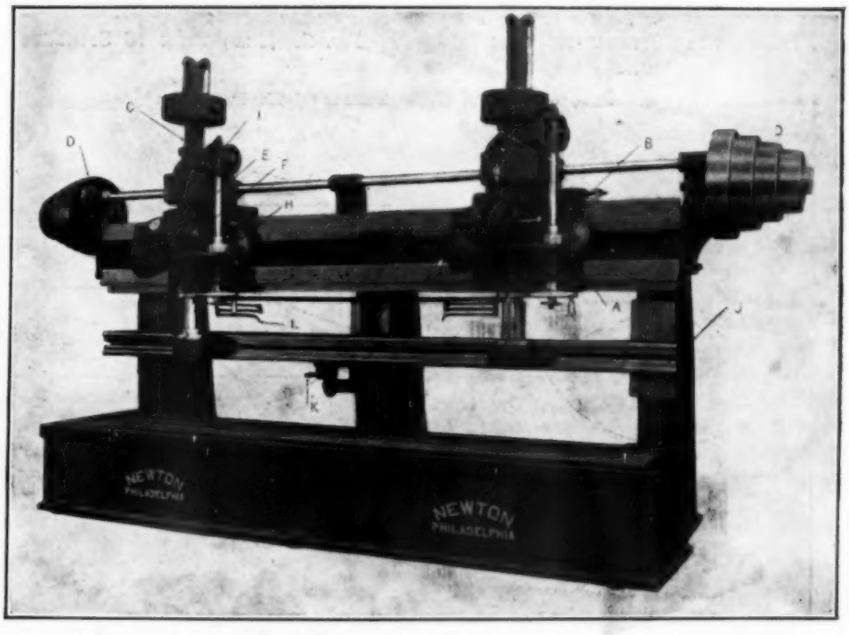
The halftone shows a new design of duplex rod boring machine which has been brought out by the Newton Machine Tool Works, Inc., Philadelphia, Penn.

This machine has been developed to obtain the maximum output from the best grades of high-speed steel and to increase the rigidity by properly supporting the spindles, thus increasing the number of parts for which the machine can be successfully used. This range of work now includes the driving boxes. The body of the machine proper consists of a very massive base, the top surface of which, after being finished and slotted for the reception of bolts, is used for the working surface. This working surface is 16 feet 6½ inches long by 24 inches wide and is surrounded by an oil pan. To this base are attached three heavy uprights to which the rail is attached. The rail is massive, of box type construction braced internally by a number of thick ribs, and it serves as a reservoir for lubricant. The spindle saddle has an angular bearing on the bottom surface of the rail, insuring close contact under heavy pressures. The top bearing is square, the adjustment being made by means of a bronze taper shoe on the top and on the rear by a gib bolted to the saddle. At *A* is shown the adjusting nut fitted to the hook bolt, engaging the inside of the shear to hold the saddle in any pre-determined position on the rail and at *B* is shown the pinion, the solid end of which is squared to fit a removable ratchet. This adjusts the saddle crosswise. The spindles are each 4¼ inches diameter running in bushed bearings in the sleeve which has a bearing of 28½ inches over all. The outer diameter of the sleeve is 5¾ inches. The length of the spindle feed and hand vertical adjustment is 16 inches. The spindle is fitted with a No. 6 Morse taper, threaded externally and fitted with circular nuts which engage the key fitted through the spindle and cutters to facilitate removing the cutter or to draw it tightly in place. The spindles are driven by worm and worm wheel, the worm wheel having a bronze ring with teeth of steep lead, the driving worm being of hardened steel with roller thrust bearings. Both of these are incased for continual lubrication. The extension of the spindle fitting in the rack sleeve revolves in brass bushings and presses against a fiber washer, which takes the thrust. The upper end of this spindle and rack sleeve are incased and protected from dust and dirt by the cover *C*, which serves as a support for the counterweight. A very important feature in this design is that the thrust of the driving worm is taken by bearings cast solid with the saddle. For ordinary requirements the drive is through spur gears from the four-step cone as shown at *D* and where desired for motor or belt connection, back gears are placed on the drive, giving a spindle rotation with a range of 10 to 1. This permits of drilling stud pin holes and finishing both externally and internally the projections for oil cups. Motion for the feed is taken through spiral gears, one of which is mounted on the spindle sleeve at *E*, the other is keyed to the horizontal pull-pin shaft shown at *F*, on which are also mounted four pull-pin gears giving four changes of feed, which are transmitted to the rack sleeve through the worm and worm wheel at *H* and *I*. This motion is clutched at *H* by means of a cone friction, which connection permits of power feed or hand elevation. The saddles can be adjusted on the rail from a minimum distance between centers of spindles of 30 inches and a maximum distance of 11 feet 4 inches. The distance from the bottom of the spindle to the work table with spindle in its highest position is 25½ inches. The feeds per revolution of spindle are 0.0023, 0.0042, 0.0070 and 0.0118 inch. At *J* is clearly shown the auxiliary support for the spindles which has a bearing on each upright and hand elevation through worm and worm wheel by means of the mechanism at *K*. This bearing is to securely support the spindle at the lowest possible point when cutting.

Several of these machines are in use and are daily boring both ends of a rod at the same time. Rods 5 inches thick with holes 10 inches diameter can be bored in 20 minutes. Only one cut is taken, the next operation being a reaming cut which completes the boring operation.

When motor driven a General Electric type CQ10-10-horsepower motor, 220-volts, having a speed range of from 400 to 1200 revolutions per minute, has been used. The approximate net weight of this machine is 28,500 pounds.

The floor space required is 14 feet 2 inches by 5 feet 5 inches. Machine is furnished complete with pump, piping and attachments for lubrication and the method of delivering the lubricant to the cutter by means of the floating pipe shown at *L*. Extreme care has been taken to protect operators as practically all exposed gears have been covered.



A DUPLEX ROD-BORING MACHINE

A Multiple Drilling Machine

A special multiple drill, its three drill heads, diagrams of holes drilled with each—all for drilling seven important pieces of an office machine—are shown by the illustrations accompanying this article. They are from the factory of the Langelier Manufacturing Company, Providence, R. I.

Fig. 1 shows the machine itself. The belt drive is from a shaft at the bottom and rear over idlers to the spindle pulley. The driving shaft carries a stepped cone, providing three speeds, all that are needed for the combinations of drills used. The drill feed is accomplished by raising the table by means of a large pilot wheel geared to the rack on the table. A pair of reducing gears increase the mechanical advantage and aid in giving a powerful feed.

The table has a working surface of 18x26 inches. It is counterbalanced and has a vertical movement of 4½ inches. The tables slides in a knee that can be adjusted and fastened in different positions. This knee has a vertical adjustment of 6 inches. The greatest distance from the end of the drill chuck to the lowest position of the table is 12 inches. A handwheel and screw raise and lower the knee.

Turning to the three heads, shown by Figs. 2, 3 and 4, the first has the necessary combinations of spindles, 16 in all, for drilling two aluminum pieces each in one operation. The second has 24 spindles arranged to drill five pieces each in one operation, except two long narrow pieces that require two operations each. The third head has 44 spindles arranged to drill four cast-iron pieces each in one operation. Figs. 5, 6

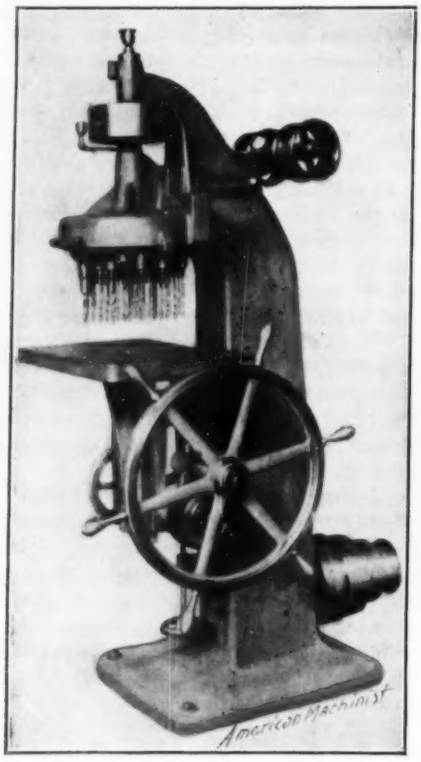


FIG. 1. MULTIPLE SPINDLE-DRILLING MACHINE

FIG. 2. HEAD WITH 16 SPINDLES

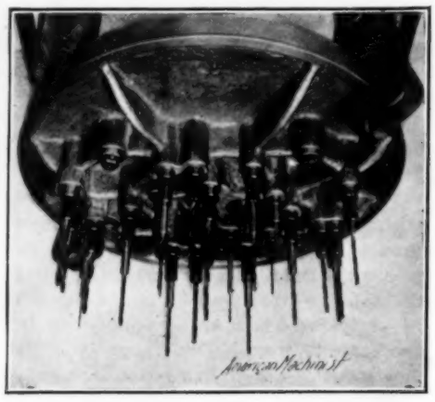


FIG. 3. HEAD WITH 24 SPINDLES

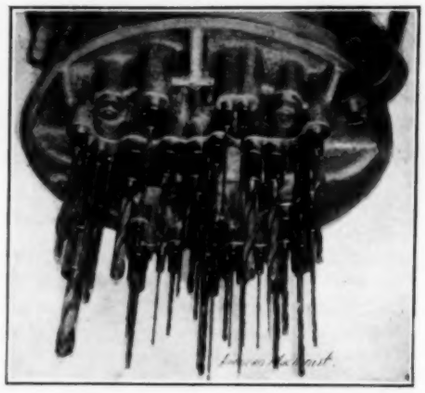


FIG. 4. HEAD WITH 44 SPINDLES

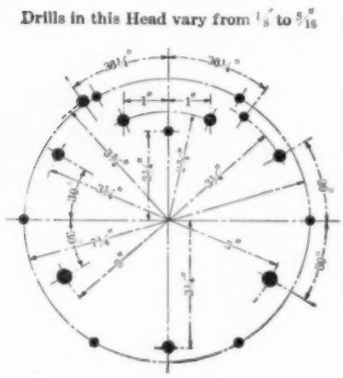


FIG. 5. LAYOUT OF SPINDLES IN HEAD OF FIG. 2

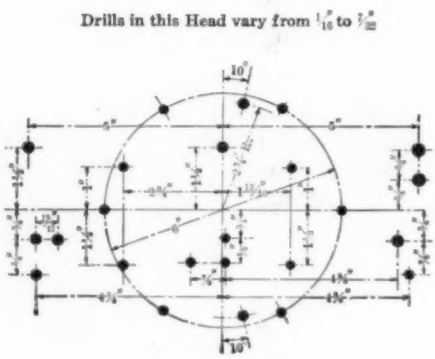


FIG. 6. LAYOUT OF SPINDLES IN HEAD OF FIG. 3

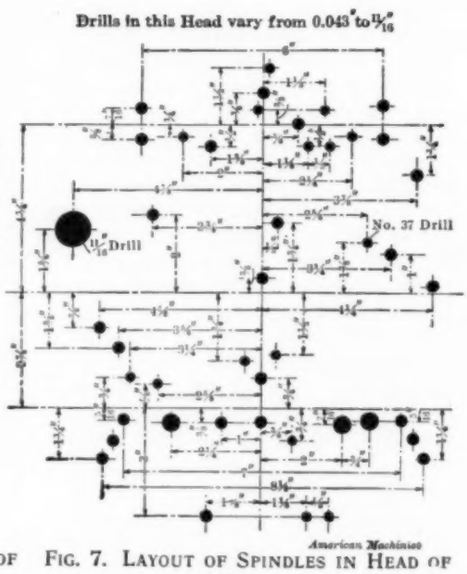


FIG. 7. LAYOUT OF SPINDLES IN HEAD OF FIG. 4

and 7 show the arrangement of spindles, or holes that they drill, for the three heads.

As built, only these three heads were provided. The drilling machine, however, can be used for other heads having different layouts of spindles, provided the holes all fall within the area of a circle 13½ inches in diameter.

Electric Power Required to Melt Metals

In a paper by Prof. Joseph W. Richards, of Lehigh University, presented before the American Brass Founders' Association, there is set forth a table showing the amount of heat required to melt a given quantity of various metals. Based upon these data the paper gives comparisons with different fuels, these being expressed as percentage efficiencies of what theoretical conditions would accomplish in the melting of a given quantity of brass or bronze, and superheating it 10 per cent. to make it ready for pouring.

With 100 per cent. efficiency it would require 0.019 pound of coke to melt one pound of bronze, or one pound of coke would melt 54 pounds of metal. If in practice 10 pounds are melted, the efficiency is obviously $10 \div 54 = 0.18$, or 18 per cent.

Burning oil having a heat value of 20,700 B.t.u. per pound it would require, at an efficiency of 100 per cent., 0.0113 pound per pound of bronze, or one pound of oil might melt 88 pounds of alloy. If in practice the oil melts 15 times its weight, the thermal efficiency of the furnace is $15 \div 88 = 17$ per cent.

With an electric furnace and assuming 100 per cent. efficiency, to melt one pound would require 0.07 kilowatt-hour, or 0.09 horsepower-hour. This would mean that 1 kilowatt-hour should melt 14 pounds of metal with 100 per cent. efficiency. If in actual practice 1 kilowatt-hour melts seven pounds, the thermal efficiency of the furnace is 50 per cent.

To compare the various methods of melting, the paper further goes on to say that if one pound of coke melts 10 pounds of metal, one pound of oil melts 15 pounds of metal and 1 horsepower-hour melts 5½ pounds, the relative values of these melting agents are: One pound coke = 0.67 pound oil = 1.8 horsepower-hour.

Put into dollars and cents, this would mean that coke at $4 per ton equals oil at $6 per ton, equals power at $12.25 per horsepower-year. From these figures it would appear that coke would be everywhere the cheaper; but in Norway, with coke costing $6 per ton, and electric power not over $10 per horsepower-year, the electric furnace is the cheaper. Moreover, with the crucibles destroyed, labor and deterioration of metal taken into account, the electric furnace may be the cheaper in many other localities than Norway, besides some electric furnaces are working at efficiencies nearer to 75 per cent. than 50 per cent.

Increasing Shop Capacities

Metal Working

NEW ENGLAND

Kilstrom & Bamber will install a jewelry shop at 9 Calender street, Providence, R. I.

The Rex Horseshoe Company is to open a plant at Central Falls, R. I.

The Warren (Mass.) Cotton Mills has commenced the erection of a new machine shop.

The Ritzler Metal Manufacturing Company, Kansas City, Mo., will erect a new building.

The factory of the White-Warner Stove Company, Taunton, Mass., was badly damaged by fire.

The Uniform Seamless Wire Company, Providence, R. I., is to open a branch of its business in that city.

The American Shear and Knife Company, Woodbury, Conn., is said to be considering the removal of its plant.

The H. W. Hakes Manufacturing Company, Millbury, Mass., will shortly open a factory for manufacturing mill wire gods.

The Peck-Clarke Company, Brookfield, Vt., is looking for site for a new plant. The company manufactures hoes, rakes, etc.

The Malleable Iron Works, New Britain, Conn., manufacturing malleable-iron castings, will erect an addition to its foundry.

The J. L. Thompson Company, Roberts, Mass., manufacturing rivets and metal specialties, is erecting an addition to its plant.

Fire at the machine-knife works of Bailey & Bienbindger, Woburn, Mas., destroyed the tempering and grinding rooms. Loss, $15,000.

Pickard Brothers, automobile manufacturers, Brockton, Mass., have been considering the advisability of removing their plant to some other location.

News items for the sales department—where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip—facts.

The Adams-Farnham Company, Minneapolis, Minn., building traction engines, is arranging to move its plant to some western city in the wheat belt.

The Remington Manufacturing Company, Attleboro, Mass., has been incorporated for $10,000 to manufacture jewelry. A new plant is contemplated.

W. B. Grant, Boston, Mass., has purchased the Swanscott Machine Company, of Newfields, N. H., and will operate same. New machinery will be installed.

The Wentworth Institute, Boston, Mass., will erect a foundry, a power plant and a machine shop. New equipment for the same will be needed in the near future.

The American Trolley Retriever Company, Providence, R. I., has been incorporated for $100,000 to manufacture and deal in machinery. The incorporators are Geo. W. Bugbee, R. F. Leaven and A. H. Whatley.

C. H. Ruggles, Houston, Tex., has been investigating throughout the southern section preparatory to securing suitable location for a new general machine shop and foundry for the manufacture of a new car wheel.

The American Railway and Supply Trinidad, Colo., which is a consolidation of the Haigh Swivel Car Axle Company, and the Wall Railroad and Supply Manufacturing Company, is planning the erection of a large new plant.

The Shock and Hay Loader Company and Valentine Brothers Manufacturing Company, Minneapolis, Minn., have consolidated under the name of the Imperial Machinery Company. New building is being erected at 1601 Central avenue. Tractors and hay loaders will be manufactured.

The Westfield (Mass.) Foundry and Valve Company, a new concern, has purchased site on Union street and will erect a plant for the manufacture of brass and iron valves. C. O. Churchill, of Binghamton, N. Y., formerly superintendent of the Georgian Company, and L. Holst, general foreman, will be in charge of the new company.

MIDDLE STATES

The plant of the Aurora (Ill.) Boiler Works was destroyed by fire.

The Auto Stove Works, New Athens, Ill., contemplates an addition to its factory.

The plant of the Philadelphia (Penn.) Iron Works was destroyed by fire. Loss, $50,000.

The Michigan Pressed Steel Company, Detroit, Mich., will erect a new $60,000 factory.

The plant of the Rockaway (N. J.) Rolling Mill is to be enlarged and machines for the manufacture of railroad spikes installed.

The machine shop of the Acme Brass Tube Works, Cleveland, Ohio, was destroyed by fire.

The Frog Switch and Manufacturing Company, Carlisle, Penn., is having an addition built.

The Savill-Chandler Company, Canton, Ill.,

is building an addition to its foundry and machine shop.

The plant of the Oneida Community Silver Company, Niagara Falls, N. Y., was destroyed by fire.

The American Rolling Mill Company (sheet mill), Zanesville, Ohio, will make improvements to its plant.

The Cleveland, Cincinnati, Chicago & St. Louis Railroad Company will erect car shops at Springfield, Ohio.

The Central Railroad of New Jersey will build new car shops at Red Bank, N. J., at a cost of about $500,000.

Fire caused $10,000 damage to the plant of the Noekle-Richards Iron Works on East Palmer street, Indianapolis, Ind.

The George H. Soffel Company, Pittsburg, Penn., will build a five-story factory for the manufacture of plumbers' supplies.

Work has been commenced on a $25,000 foundry for the Syracuse Malleable Iron Works, North Geddes street, Syracuse, N. Y.

The One Minute Washer Company, Sandusky, Ohio, is to erect a new plant and increase the output of its washing machines.

The I. B. Powell Company, of Menominee Falls, Wis., is considering the removal of its gray-iron foundry to some other location.

The Union Drop Forge Co., Chicago, Ill., has begun the erection of a new $300,000 plant. Present plant is at Ohio and Orleans streets.

The Rex Aërial Navigation and Construction Company is preparing to erect a plant at Huntingdon, Penn., for the manufacture of aëroplanes.

It is stated that the work on the enlargement of the Schoen Steel Car Works, at McKeesport, Penn., will be commenced in the near future.

The S. G. Taylor Chain Company, of Chicago, Ill., and Maxwell, Ind., has purchased site at Hammond, Ind., where a new plant will be erected.

The repair shops of the wagon, truck and carriage works of H. Kaiser & Co., Twenty-third and Race streets, Philadelphia, Penn., were gutted by fire.

The George E. Cove Biplane Company is being incorporated at Bridgeton, N. J., to manufacture an aëroplane invented by Mr. Cove. Capital, $100,000.

Kennedy & Brown, Oil City, Penn., are interested in the erection of a large new foundry to be erected in the Middle Atlantic section on site to be secured.

The Hess Steel Company has awarded contract for the construction of a plant in Bridgeton, N. J., which is to contain 16 crucible-steel smelting furnaces.

Aluminum Specialties Company, Fulton, N. Y., has been incorporated to make aluminum ware. Capital, $75,000. Incorporator, Thos. S. Jackson, and others.

The Judd & Leland Manufacturing Company, of Clifton Springs, N. Y., will build a large new addition to its plant. The concern manufactures tinware.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 20, for one 18-inch lathe as per Schedule No. 3127.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 6 for one plate-bending machine as per Schedule 3093.

Kraus Motor Sales Company, Cleveland, Ohio, has been formed to operate a sales agency and repair shop by J. M. Ulmer, E. F. Kraus, J. M. Bernstein, etc.

The Kenmore Manufacturing Company, Chicago, Ill., manufacturing automobiles, having outgrown its present quarters, is looking for site for a new and larger plant.

The Electrolytic Products Company will erect a two-story brick building at 1877 Elmwood avenue, Buffalo, N. Y., where radiators for automobiles will be manufactured.

Fire damaged plants of the Signal Central Crescent Company, Sure Seal Company, Ideal Die Company, Blair Tool and Machine Company, at 24-27 West street, New York.

The Stuyvesant Motor Car Company has taken over the old plant of the Warren Electric Manufacturing Company, at Sandusky, Ohio, and is making necessary alterations.

The Elgin (Ill.) Giant Watch Case Company, recently incorporated, is planning to erect a plant. Walter Bachrach, Chas. J. Wendland, S. Sidney Stein are incorporators.

The Fairbanks Company is erecting an eight-story building at Liberty avenue and Twenty-sixth street, Pittsburg, Penn., to be used as a general repair shop and warehouse.

The Ward Nail Company, of Sharon, Penn., is completing arrangements to lease a plant at Struthers, Ohio, where it will install machinery for the manufacture of large-headed nails.

The Conqueror Stove Company, Chicago, Ill., has incorporated with $10,000 capital. Will manufacture stoves and ranges. Incorporators, S. Cohen, Fred M. Pitt, Geo. F. Hagemeyer.

The De Hart Motor Car Company, Jersey City, N. J., has been incorporated to manufacture automobiles. Capital, $10,000. Incorporators, Wm. F. Ely, Frank J. Higgins, R. G. Butler.

S. E. Allen, of Dansville, N. Y., head of the New Commercial Iron Works, a new concern, is negotiating with the Business Men's Association, of Penn Pan, N. Y., to establish a plant there.

The Banner Manufacturing Company, Ferdinand, Ind., is erecting a factory to be used as a foundry and machine shop. Lathes, drills, etc., will be needed, also a complete foundry equipment.

The Caldwell Lawn Mower Company, whose plant at Newburgh, N. Y., was recently destroyed by fire, will relocate immediately in the property known as Newburgh Steam Mills.

The Gath Machine Tool Company, Buffalo, N. Y., has been incorporated with $10,000 capital by Andrew L. Gath, Owen B. Augsperger, Geo. A. Orr, etc., to take over business of Gath & Gardner.

Two continuous mills will be erected by the Republic Iron and Steel Company to take the place of the last four hand mills at the Brown-Bonnell plant, Youngstown, Ohio. The work will be started next May.

Jungclas Automobile Company, Cincinnati, Ohio, has been incorporated with $10,000 to operate a sales agency and garage. William C. Jungclas, Edward H. Jungclas, R. E. Morrison, and others, incorporators.

Madison T. B. Washington Company, New York, has been incorporated to manufacture automobiles, machinery, etc. Capital, $100,000. Incorporators, M. T. B. Washington, M. W. Gilbert, J. S. Brown, Jr.

Kelly Automobile Company, Youngstown, Ohio, incorporated at $15,000, to operate a sales agency and garage. R. M. Kelly, Jr., Earl F. English, Anna B. Kelly, R. D. Gibson and W. F. Gibson, incorporators.

The Rassel Motor Car Company, Toledo, Ohio, has been organized to manufacture and sell automobiles and parts. Incorporators, Edward C. Rassel, Richard D. Logan, William E. Brown, etc. Capital, $125,000.

The Meadows Sheet Metal Works, Meadows, Ill., has been incorporated to manufacture steel grain spouts, tanks, etc. Capital, $15,000. Incorporators, Edwin Whorrall, D. N. Claudon, R. L. Rathbun, etc.

The French Auto Top and Supply Company, Chicago, Ill., has been incorporated to manufacture automobile accessories. Capital, $10,000. Incorporators, Emil C. Wetten, Chas. H. Regier, Jas. H. Christensen.

The Clawson Vending Apparatus Company, Newark, N. J., has been incorporated with $125,000 capital to manufacture vending machines. Incorporators, Clement C. Clawson, Geo. A. Ohl, Jr., Chas. F. Lehlbach.

The White Plains Garage Company, White Plains, N. Y., has incorporated to sell and repair automobiles, etc. Capital, $10,000. Incorporators, Ernest E. White, Lala Groser, Willard J. Gidley, all of White Plains.

The Consolidated Casting Company, Mechanicsville, N. Y., has been incorporated to manufacture all kinds of castings. Capital, $20,000. Incorporators, A. H. Trumbull, Syracuse; R. W. Tompkins, Mechanicsville, etc.

Faultless Machine and Manufacturing Company, Akron, Ohio, has been formed with $10,000 preliminary capital, to manufacture all kinds of machinery. C. A. Wild, Edward W. Paul, Edward G. Major, incorporators.

The Mackey Motor Company, Newark, N. J., has been incorporated with $300,000 capital by J. C. Mackey, W. G. Jerolemon, Newark; R. M. Bateman, East Orange. Will manufacture automobiles, motor boats, engines, etc.

The Jewelers and Silversmiths Company, New York, has been organized to manufacture jewelry and silverware, by H. H. Galinger, T. Kensett Wheeler, Edward Galinger, 25 Broad street. Capital, $500,000.

Friend Manufacturing Company, Mansfield, Ohio, has been incorporated to manufacture and develop all kinds of machinery. Capital, $10,000. Incorporators, Berthold Friend, William H. Friend, S. W. Friend, M. Lewis, etc.

The Stewart Manufacturing Company, New York, has been formed to manufacture gas burner and heater. Capital, $10,000. Incorporators, E. W. Stewart, 154 Nassau street; Hannah G. and Ada Gould, 35 West Ninety-fourth street.

The Otto Motor Car Company, of New York, has incorporated with a capital of $50,000 to manufacture motor vehicles, engines, machinery, etc. Incorporators, J. J. McDonald, New York; J. M. Lang, H. A. Bedell, Brooklyn.

The R. D. Nuttall Company, Pittsburg, Penn., has purchased site at Claremont and proposes the erection of a plant to cost about $1,000,000. The company manufactures gears and is a subsidiary of the Westinghouse enterprises.

The Sweetser Iron Works, New York, has been incorporated to manufacture iron, steel and metal building materials. Capital, $10,000. Incorporators, Warren C. Sweetser, 286 Fifth avenue; H. R. Patten, Geo. B. Currier, 449 Fourth avenue.

The Cleveland Metal Products Company, Cleveland, Ohio, has been incorporated to manufacture and sell metal products of all kinds. Incorporators, E. A. Doad, H. R. Drury, Edwin Heina, A. F. Hills and G. R. Collar. Capital, $200,000.

Fire destroyed the principal shop building of the Coldwell Lawn Mower Company, Newburgh, N. Y., causing a loss of about $165,000. The company, however, has a new addition nearly completed and is in the market for considerable new equipment.

The Manufacturing Equipment Company, Dayton, Ohio, recently incorporated, is erecting a plant in North Dayton. A full line of machine supplies will be manufactured. J. L. Schroll is president and temporary offices are in Kramer Brothers' foundry.

The Columbus Electrical Manufacturing Company, Columbus, Ohio, has been incorporated with $125,000 capital to manufacture and sell electrical scales, weights and weighing devices. Incorporators, Walter S. Smith, Walter F. Fenton, George W. Wolfley, etc.

Morse Tool Manufacturing Company, New York, has been incorporated with $200,000 capital by Alex Morse, 612 West One Hundred and Thirty-fifth street; W. A. Rembert Hall, 31 East Forty-ninth street, and others. The concern will manufacture tools, wrenches, etc.

Randerson Auto Parts Company, New York, has been incorporated with $25,000 capital to conduct machine and repair shop, manufacture and deal in auto parts and accessories. Incorporators, J. F. Randerson, Albany; E. G. Trimper, R. P. Herrick, New York.

A new pattern shop is being erected at the shops of the American Can Company, Maywood, Ill., present quarters to be used for die and tool departments and extension of special metal-working machinery section. Additional equipment will be required. Machine tools, motors, etc.

The Bauer Metallized Bronze Company, Brooklyn, N. Y., has been incorporated to manufacture metal articles. Capital, $12,000. Incorporators, John F. Connor, 437 Putnam avenue, Brooklyn; Frank A. Scott, 14 Melville place, Woodhaven, N. Y.; Frank Van Buren, 438 East One Hundred and Sixty-fourth street, New York.

The Ward Motor Vehicle Company, New York, has incorporated for the purpose of manufacturing motors, engines, machinery, etc. Capital, $200,000. Incorporators, Chas. A. Ward, Wm. B. Ward, Concord avenue and East One Hundred and Forty-third street. Lester S. Kafer, 2 Rector street.

The North American Electrical Manufacturing Company, New York, has incorporated to manufacture electrical machinery, etc. Capital, $100,000. Incorporators, John T. Milligan, 248 Emerson place, Brooklyn; P. E. Wye, 164 Front street; H. M. Kidder, 38 West Ninth street, New York.

SOUTHERN STATES

The Virginia Railway and Power Company, Richmond, Va., will erect a blacksmith shop.

Work has been started on new car-repair shops at Newport News, Va., for the Berwind-White Coal Company.

W. E. Selvidge has purchased the Eagle Brass Works, Chattanooga, Tenn., and it is said will enlarge his plant.

Davis & Satterfield, Chestertown, Md., have awarded contract for the erection of blacksmith and wheelwright shops.

The foundry of Levering Brothers, of Baltimore, Md., at Hanover, Penn., was destroyed by fire. Will be rebuilt.

The Good Luck Baking Powder Company, Richmond, Va., will erect a three-story building for the manufacture of cans.

The Crass Aëroplane and Exhibition Company, Richmond, Va., is being formed to manufacture an aëroplane invented by James E. Crass, Jr., of that city.

The Sistersville (W. Va.) Boiler Works has been incorporated to manufacture boilers. Capital, $25,000. Incorporators, E. A. Ryan, J. P. Ryan, H. W. McCoy, etc.

WEST OF THE MISSISSIPPI

The Santa Fe Railroad will erect a repair shop for light work at Daggett, Cal.

The Morton Sashweight Company, Kansas City, Mo., is looking for a suitable site for a new plant.

The Pullman Company, which has just completed new shops at Pullman, near Richmond, Cal., has decided to erect duplicate buildings.

The Gold Dust Mines Company, operating in the Mogollon district, near Silver City, N. M., is building a new blacksmith shop and making additional improvements.

L. Vignolo, Los Angelse, Cal., has taken out a permit to erect a commercial garage at San Pedro and Washington streets. Modern repair machinery will be installed.

The Field Automobile Manufacturing Company, Lincoln, Neb., has been incorporated with $2000,000 by W. T. Field, Chas. E. Gibbs, Frank Farrell, P. F. Zimmer.

The plant of the Las Vegas Iron Works, Las Vegas, N. M., was destroyed by fire. Loss, about $10,000. The plant will be immediately rebuilt and new machinery installed.

The National Perforating Machine Company, of Kansas City, Mo., has been investigating throughout the New England section with a view of securing site for a plant.

CANADA

The Modern Machine Company will double its plant in Toronto.

The Taggart Iron Works will build a large plant at St. Boniface, Manitoba.

The National Hardware Company will double its lock factory at Orillia, Ont.

The foundry of E. E. Reeb & Sons, Port Colburn, Ont., was burned. Loss, $15,000.

The Regina Plumbing and Heating Company will build a factory at Regina, Sask.

The Twin City Hoisting and Manufacturing Company will build a big factory at Winnipeg.

The Ontario Brass Rolling Mills, of Toronto, will nearly double its plant at New Toronto. One hundred thousand dollars is to be spent on new machinery for the manufacture of wire and small articles in brass and copper.

GENERAL MANUFACTURING

NEW ENGLAND

The town of Westfield, Mass., is enlarging its gas plant.

Greenburg Brothers are to open a shirt factory at Medway, Mass.

The town of South Hadley, Mass., is taking figures on waterworks equipment.

The Metcalf comb factory, Leominster, Mass., was badly damaged by fire.

The Lapworth Webbing Company, Brockton, Mass., will erect an addition.

A power plant will be erected at the State Normal School, Bridgewater, Mass.

Col. H. L. Williams is to open a new basket factory at Northampton, Mass.

The A. Merriam Company, South Acton, Mass., is building a new power plant.

The Northampton (Mass.) Gaslight Company is to build additions to its plant.

The Monmouth Electric Company, Monmouth, Me., is increasing its equipment.

The Soule Mill Corporation is to erect a 5-story factory at New Bedford, Mass.

The Webster Felt and Rubber Company is to shortly open a plant at Webster, Mass.

The Mente Bag Company's factory at South Boston, Mass., was badly damaged by fire.

The National Wafer Company, Charlestown, Mass., will install boiler, engine and pump.

Fire destroyed the factory of the Orleans Bobbin Company, Newport, Vt. Loss, $10,000.

The Cranston Worsted Mill, at Bristol, R. I., will erect a 4-story addition to its plant.

The Namquitt Worsted Mills, of Bristol, R. I., will add to its factory and equipment.

The Allen Fire Department Supply Company, Providence, R. I., is to erect a factory.

The W. H. McElwain Shoe Company is to erect a large box factory at Portsmouth, N. H.

The Hampden Glazed Paper Company, Holyoke, Mass., will erect a four-story addition.

The Maine insane hospital, Augusta, Me., is to be equipped with a refrigerator system.

The Central Maine Power Company, Farmingdale, Me., will erect a steam electric plant.

New additions are being added to the Finlayson Flax Mills, North Grafton, Mass.

The plant of the Eastern Paper Box Company, Hartford, Conn., was damaged by fire.

The Washburn Wringer Company is contemplating locating a factory at Webster, Mass.

The town of Newburyport Mass., will install a new pmup of 1,000,000 gallons capacity.

The Lafayette Worsted Company, of Woonsocket, R. I., will install an 800-horsepower turbine.

The plant of the Woodstock (N. H.) Lumber Company was almost destroyed by fire recently.

The North Pownal Manufacturing Company, North Pownal, Vt., will install 10,000 spindles.

The Boston Ice Company, Charlestown, Mass., will install a chain or belt and bucket conveyer.

The Heinze Electric Manufacturing Company, Lowell, Mass., is to remove its plant to Detroit, Mich.

C. W. Hutchinson & Son, Springfield, Mass., are to enlarge their concrete-block manufacturing plant.

The Sanford Mills, Medway, Mass., are to install a sprinkler system and also erect a dye house.

Fire damaged the plant of the Macrodi Fibre Company, of Woonsocket, R. I., to the extent of $5000.

Joseph Benn & Sons, Inc., will install a large steam turbine in their new mill at Greystone, R. I.

The town of Warwick, R. I., will build a school house at Greenwood, R. I., and install heating apparatus.

Fire damaged the plant of the G. S. Collins Wicking and Sanitary Napkin Company, Central Village, Conn.

Chas. I. Howell is having a button factory erected at Waltham, Mass., which will employ 800 hands.

It is stated the New Bedford (Mass.) Box Company is looking for site on which to erect a larger plant.

The Providence Box and Lumber Company, Providence, R. I., is having a new factory erected in that city.

Boston, Mass., will erect a new High School of Commerce. Steam-heating apparatus will be needed.

The Niantic Bleachery Company will establish a million-dollar plant and employ 500 hands at Niantic, R. I.

The George H. Gilbert Manufacturing Company, Gilbertville, Mass., is to erect an addition to its woolen mills.

Twelve thousand dollars is to be expended in a new heating and lighting plant at the Lyman School, Westboro, Mass.

The plants of the Cranston Worsted Company, and Namquit Worsted Company, Bristol, R. I., are to erect additions.

Leonard & Barrows, shoe manufacturers, Belfast, Me., are looking for a larger building, having outgrown present one.

The Greenfield (Mass.) Gaslight Company has issued $50,000 new stock to cover contemplated improvements to its plant.

The American Writing Paper Company's plant at Holyoke, Mass., was badly damaged by a flywheel explosion. Loss, $6000.

The Beacon Manufacturing Company, New Bedford, Mass., is to erect a new plant. The company manufactures cotton blankets.

The plants of the Churchill & Alden Shoe Company, and the Brockton Webbing Company, Brockton, Mass., were badly damaged by fire.

The plant of Isaac Prouty & Co., shoe manufacturers, Spencer, Mass., is to install a 500-pound engine. A new printing plant is also to be erected.

The G. A. Learned Shoe Company, Newburyport, Mass., has purchased the Barton factory at Lawrence, Mass., and will remove its business there. Five-story addition will be built later.

MIDDLE STATES

The Goldsmith Detinning Company, Chrome, N. J., is building an addition.

Fire destroyed the pencil factory of Oscar Weissenbom, Jersey City, N. J.

The Catoir Silk Company, West New York, N. J., will erect a new factory.

The Detroit (Mich.) Show Case Company is to build a four-story addition.

Fire destroyed the plant of the E. J. Lindsay Saddlery Company, Chicago, Ill.

The Carrier-Low Box Company, Rockdale, Ill., is erecting extensions to its plant.

American Steel and Wire Company, Cleveland, Ohio, will erect a new pump house.

The George Stratford Oakum Company, Jersey City, N. J., will erect an addition.

Fire destroyed the plant of the William Flynn Cornice Company, Wilmington, Del.

The Brown Knitting Company, Warsaw, N. Y., is putting up a four-story dye house.

The Keever Starch Company, South Columbus, Ohio, will build additions to its plant.

The factory of the Wisconsin Pharmacal Company, Milwaukee, Wis., will be doubled.

Kessler & Co., Cleveland, Ohio, manufacturers of chemicals, will erect a new factory.

The Pabst Brewing Company will erect an addition to its plant at Milwaukee, Wis.

The World Knitting Company, Philadelphia, Penn., will triple the size of its plant.

The plant of the Zanesville (Ohio) Barrel Company, recently burned, is to be rebuilt at once.

The Edwards Company will erect a large lumber-manufacturing plant at Rouses Point, N. Y.

The Lakeside Paper Company, of Menasha, Wis., will construct a paper mill there next spring.

The Listers Agricultural Chemical Works, Newark, N. J., will erect a new factory building.

The plant of the East Jersey Pipe Works, Paterson, N. J., was destroyed by fire. Loss, $25,000.

The cotton-duck plant of John Boyle & Co., Bayonne, N. J., was destroyed by fire. Loss, $20,000.

The Manor (Penn.) Handle Company is looking for suitable location on which to erect a plant.

Fire did $15,000 damage at the plant of the Jamestown (Penn.) Paint and Varnish Company.

Carriage works of J. W. Dill, Harrisburg, Penn., was destroyed by fire. Loss, $10,000. Will rebuild.

The piano factory of E. G. Harrington, 637 West Forty-ninth street, New York, was destroyed by fire.

The Lawrence Clay Products Company, Canton, Ohio, will build a new plant at North Lawrence, Ohio.

Fire did $9000 damage to the chair factory of August Wenice, 384 Smith street, Brooklyn, N. Y.

The Van Camp Packing Company, of Indianapolis, Ind., has decided to erect a plant at Adrian, Mich.

The Sexton Manufacturing Company, of Fairfield, Ill., will establish a knitting mill at St. Louis, Mo.

The H. J. Heinz Company is building a six-story addition to its preserving plant at Sharpsburg, Penn.

Bids are about to be let for new power-plant equipment at Freedman's Hospital, Washington, D. C.

The Hill Bread Company, Newark, N. J., will build a new power plant. Install new engines and boilers.

The Endeavor (Wis.) Electric Light and Power Company will build a new generating plant in the spring.

The Jacob H. Meyer Silk Manufacturing Company, Siegfried, Penn., will erect a power house and silk mill.

The Delavan (Wis.) Condensed Milk Company is planing the erection of a branch factory at Clinton, Wis.

The American Pad and Textile Company, of Greenfield, Ohio, will build a branch plant at Chatham, Canada.

John Sandy, I. N. Cash, E. E. Sluss, Monticello, Ohio, will erect a factory for the manufacture of cement tile.

The Menominee River Sugar Company, Menominee, Wis., will build a new beet pulp dry house to cost $150,000.

George W. Wiedenmeyer, Newark, N. J., will build a new power house. New engines and boilers will be installed.

The Huri Manufacturing Company, manufacturer of varnishes, will build a factory in Emmett street, Newark, N. J.

The East St. Louis-New Athens Brewing Company, New Athens, Ill., is in the market for a 50-ton refrigerating plant.

The Frankfort Paper Company has leased a building at Frankfort, N. Y., and will begin the manufacture of tissue paper.

Fire damaged the plant of the Buffalo (N. Y.) Lounge Company, 190-192 Myrtle avenue, Buffalo. Loss, $10,000.

A complete heating plant will be required for a new high-school building to be built at Washington Court House, Ohio.

B. V. Gundling Company will build a new factory at West New York, N. J., for the manufacture of sash, blinds, etc.

Flint, Mich., has voted to issue $400,000 bonds for improvements to waterworks system, including a modern filtration plant.

The Beckley Perforating Company, Garwood, N. J., is building a new power plant. Will install new boiler and engine.

The New York Revolving Portable Elevator Company, Jersey City, N. J., is to build a new plant in the Greenville section.

Alexander Smith & Sons Carpet Company, Yonkers, N. Y., will build an addition to its spinning mill on Nepperhan avenue.

The Olson Rug Company, Chicago, Ill., has awarded contract for the erection of a new factory at Laflin and Monroe streets.

The Canestoga Portland Cement Company, Lancaster, Penn., will erect a new plant. Electric power plant will be installed.

David J. Weinreich, 1015 East Fifth street, Dayton, Ohio, is seeking a location in New York State for a large cigar factory.

Fire destroyed the factory of the Empire State Bagging Company, 742-750 Wythe avenue, Brooklyn, N. Y. Loss, $50,000.

Swift & Co., of Chicago, Ill., are said to be contemplating the erection of a fertilizer-manufacturing plant in the vicinity of Rochester, N. Y.

Fire destroyed the table and chair factory of G. H. Heckeroth, 1432-36 North Randolph street, Philadelphia, Penn., causing a loss of $25,000.

At Empire, Ohio, the Union Clay Manufacturing Company has awarded the contract for the erection of a plant at that place to manufacture pottery.

Fire destroyed the elevator of the Turner-Hudnut Company, at Pekin, Ill., on October 23, but a new elevator will be built at once on the old site.

Andrew Stone, of Green Bay, Wis., will start a furniture factory at the old Kenmitz Furniture Company's plant. New machinery will be installed.

The Buffalo Box Factory, at East Buffalo, N. Y., will erect a one-story brick building, 80x100 feet, with basement, for a corrugated paper-box factory.

Equipment consisting of engines, boilers, generators, etc., will soon be purchased for an extension of the Carnegie Technical Schools, Pittsburg, Penn.

The Wyoming Paper Mills, of Pittston, Penn., were purchased by P. F. Joyce, who will put in improved machinery and increase the capacity of the plant.

L. O. Bonquin, of Franklin, Penn., is interested in the establishment of a new and modern woodworking factory to be located in the Middle Atlantic section.

The R. T. French Company, Rochester, N. Y., manufacturing spices, will erect a new factory. Lighting plant and electrical power equipment will be installed.

Fire destroyed one of the furnaces of the copper and smelter department of the Irvington (N. J.) Smelting and Refining Works and damaged other machinery. Loss, $35,000.

The Bessemer Gas Engine Company, of Pittsburg, Penn., has commenced the construction of a $75,000 plant at Bremen, Ohio, for the manufacture of gasolene from gas.

Hardin-Wyandot Lighting Company, Kenton, Ohio, has been incorporated with $10,000 capital to build a lighting plant. W. B. Whiting, C. C. Owens, Sterling Newell, etc., incorporators.

The Manhattan Soap Company has acquired land at Thirty-first and Thirty-second streets and Eleventh avenue, New York City, where a large soap factory and warehouse will be erected.

The Wisconsin Furniture Manufacturing Company will erect a new plant at Neilsville, Wis. A complete line of woodworking machinery will be needed. Motor drive will be installed throughout.

The Vanadium Mines Company has leased the foundry property at Rankin, Penn., formerly occupied by the Blaw Collapsible Steel Centering Company, and will commence at once to do business.

The Riverside Malting Company, with plant at Black Rock, Buffalo, N. Y., has filed papers doubling its capital stock, which now makes it $200,000, and the plant will be enlarged to double the output.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 27, for one ferrule condenser machine (schedule 3100), one motor-driven power pump (schedule 3099).

The Bell Brothers Piano Company, of Lawrence, Kan., has acquired a site at

Muncie, Ind., and will erect there a plant, main building 160x60 feet, with wing 124x60 feet, three stories high.

Bell Laundry Company, Lima, Ohio, has been incorporated to operate a general laundry business, by Frank Harman, William F. Agenter, H. W. Pears, Frank L. Maire and Richard Taylor. Capital, $25,000.

The Century Paper Box Company, Rochester, N. Y., has been organized to manufacture paper boxes, etc. Capital, $20,000. Incorporators, Geo. J. Gillies, 25 Normandy avenue, Rochester; Emanuel Papas, Buffalo, etc.

The Ashtabula Worsted Mills Company, Ashtabula, Ohio, has been organized with a capital of $250,000, to build and operate worsted mills, by Andrew Dalin, Albert Strauss, Fred A. Briggs, E. W. Savage and M. A. Soules.

The H. A. Patterson Company, Cleveland, Ohio, has been incorporated with $10,000 capital to operate a general plumbing and heating business. Incorporators, R. R. Moffett, Charles A. Patterson, Robert Crosser and Paul Belle.

F. N. Burt and R. Burt, of Buffalo, N. Y., heads of the F. N. Burt Company and the Pacific Burt Company, box-manufacturing concerns, are seeking site in the Far West for a branch plant for the manufacture of cigarette boxes, etc.

The United Cold Storage Company, Milwaukee, Wis., recently organized with $700,000 capital, will erect a cold-storage plant of 600,000 cubic feet capacity on Oregon street. The company also intends to erect a plant in Madison, Wis.

McKee Light and Power Company, Sebring, Ohio, has been incorporated to manufacture and sell electrical current. Incorporators, S. E. McKee, Mrs. S. E. McKee, F. W. McKee, Mrs. Hanna McKee and William S. Hanna. Capital, $10,000.

The announcement is made at Toronto, Ohio, that the American Sewer Pipe Company will overhaul and improve the Ohio Valley plant, located at that place, and place it in operation in the spring. More than $20,000 will be used in repairs.

The Helvetia Milk Condensing Company, home office, Highland, Ill., and which has a large plant at Wellsboro, Penn., and several in the West, will build a new plant at Westfield, Penn., on New York Central tracks. Foundations are being laid and buildings will be erected probably early in the spring.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 6, for brass bolts and nuts, files, machine screws (schedule 3111), steel angles, sheet steel, solder half and half (schedule 3117), steel castings (schedule 3126), pipe fittings, brass globe valves (schedule 3105).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids December 13, for machine screws, brass wood screws, hand tools, emery cloth, hardware, steel-wire nails (schedule 3138), 1200 pounds naval brass, 700 pounds sheet brass, 250,000 pounds ingot copper (schedule 3139), 2300 pounds sheet brass, 15,000 pounds naval rod bronze (schedule 3132), 1250 pounds sheet copper, 89,800 pounds hot rolled or forged steel (schedule 3132), 40,800 pounds galvanized sheet steel, 40,000 pounds sheet zinc (schedule 3135), 44,800 pounds ingot tin, 60,000 pounds zinc boiler plates (schedule 3140).

SOUTHERN STATES

The American Ice Company, Baltimore, Md., will erect another plant to cost about $200,000.

The Lexington (Va.) Light and Power Company will install a 250-horsepower steam plant.

A. G. Morgan, 244 North Broadway, Lexington, Ky., and associates, are considering the construction of an electric-light plant.

The Consolidated Gas, Electric Light and Power Company, Continental building, Baltimore, Md., is contemplating the erection of an addition to its substation on McClellans alley.

WEST OF THE MISSISSIPPI

The Byllesby Company, Eugene, Ore., will build a gas plant.

The city of Santa Paula, Cal., will install a new sewer system.

The Colorado (Tex.) Salt Company will build a power house.

The Artic mine, near Washington, Cal., is building a power plant.

The city of Corona, Cal., will expend $60,000 in improving its water system.

The Zenith Box and Lumber Company, Duluth, Minn., will erect a new factory.

The Sperry Flour Company, Los Angeles, Cal., will erect a grain elevator at its plant.

Rothrock & Son, Centerton, Ind., will rebuild their grain elevator, destroyed by fire.

The Consolidated Water Company, Pomona, Cal., is making improvements in its water system.

The Hermosa Water Company, Cucamonga, Cal., will make improvements in its water system.

The Temescal Water Company, Temescal, Cal., will make extensive improvements in its system.

The Byllesby Company, Eugene, Ore., will erect a power plant at Springfield, Ore., to cost $350,000.

The city of Coronado (near San Diego), Cal., will expend $18,500 in improving its sewer system.

The Clarksville (Tex.) Light Company will rebuild its electric-light and ice plant, recently burned.

The city of Turlock, Cal., will vote bonds for $25,000 for the improvement of its water and sewer systems.

The plant of the Oklahoma Cotton Oil Company, Oklahoma City, recently destroyed by fire, will be rebuilt.

The National Cold Storage and Ice Company, Portland, Ore., is building a $30,000 addition to its plant.

The Pacific American Fisheries Company, at Bellington, Wash., will install new machinery in its plant.

Warren McGrath, Coachella, Cal., contemplates the erection of a cotton gin to be in operation by fall of 1911.

The Riefiin Sash and Door Manufacturing Company, Tacoma, Wash., has incorporated and will double its plant.

The Pasadena Land and Water Company, Pasadena, Cal., will make extensive improvements in its water system.

The La Habra Land and Water Company, Newport Beach, Cal., will make improvements in its water system.

The Raine Tile Works, Huntington Beach, Cal., will double the capacity of its plant. Machinery will be required.

Paul Rohrig, Oroville, Cal., will erect a hydroelectric plant at the junction of the Middle Fork and Fall rivers.

The city of Kingsburg, Cal., has voted bonds for $26,000 for a municipal waterworks and fire-protection system.

Gorman & Co., Seattle, Wash., will erect a large fish cannery at Shakan, Alaska. Construction will begin March, 1911.

The Bell Brothers Piano Company, of Lawrence, Kas., will move to Muncie, Ind., where a new plant will be erected.

The Ontario & San Antonio Heights Railway Company, Ontario, Cal., will erect a transforming station on Orange avenue.

The Canadian Fish Company, Ltd., Vancouver, B. C., will erect a large cold-storage and refrigerating plant in this section.

The city of Salinas, Cal., will expend $125,000 on a municipal gas, water and electric-light plant. Plans are nearing completion.

The city of Porterville, Cal., will expend $75,000 in improvements to its water system. Pumping apparatus will be required.

The Southern California Edison Company, Los Angeles, Cal., has begun the erection of a brick generator station at Ocean Park, Cal.

The Rubio Cañon Land and Water Association is making improvements in its irrigation system. Allin Brothers, engineers, Pasadena, Cal.

The Chamber of Commerce, at Douglas, Ariz., contemplates extensive improvements in the irrigation systems of outlying districts.

The Cadena de Cobre Company, operating in the Sahuaripa district, near Cananea, Mexico, will erect a power plant in the near future.

The Eureka Manufacturing Company, New Castle, Ind., is endeavoring to secure new site for a plant for the manufacture of tables.

The Riverside Creamery Company, Arlington, Cal., will erect a large creamery at Riverside, Cal. Modern equipment will be installed.

Mackenzie & Mann (The Pacific Whaling Company), Victoria, B. C., will build a series of freezing stations in connection with their fisheries.

W. P. Patten, Seattle, Wash., has commenced the erection of a fish cannery at Hawk inlet, near Juneau. Machinery will be required.

Equipment will be required in the new city hall to be erected at Hollister, San Benito county, Cal. C. H. Russell, architect, San Francisco, Cal.

The Harvey & Braun Fruit Company, Ontario, Cal., will build a large fruit cannery on East California street. Modern machinery will be installed.

The Ontario Promotion Company (E. H. Richardson and associates), Ontario, Cal., is planning for the erection of a large tourist hotel in this city.

The Washington Water Power Company (D. L. Huntington, Spokane, Wash.) will erect a power plant near the Nine mine on the Spokane river.

The Brennan Elkide shoe factory, located at Wilmington (near Los Angeles), Cal., will remove to Upland, Cal., and build a large factory at this place.

Steam-heating equipment will be required in the new apartment house to be erected by Mr. Buell, Los Angeles, Cal. R. B. Young, architect, Los Angeles.

The board of supervisors, San Bernardino county, Cal., will make improvements in the Mission Storm Water district in irrigation systems to cost $5000.

Bids will be received until December 8, 1910, by the board of education, Los Angeles, Cal., for 225 steel lockers to be installed at the Los Angeles high school.

A steam-heating plant will be installed in the new office building to be erected at Bak-

ersfield, Cal., by Edward Morgan. Train & Williams, architects, Los Angeles, Cal.

The Portland-Alaska Packers Association, Portland, Ore., will erect a fish cannery at Nushagak river, Alaska, of 3000 cases daily capacity. Equipment will be required.

R. M. Teague, San Dimas, Cal., contemplates extensive water and irrigation developments in Palo Verde valley. Irrigation and power-plant machinery will be required.

The Occidental Fish Company, Seattle, Wash., will erect a large cold-storage and refrigerating plant with 2,000,000 pounds of fish capacity. Equipment will be required.

The city of Upland, Cal., is contemplating the erection of a polytechnic high school to cost $75,000. Equipment will be required. H. C. Kennedy, clerk of board of trustees, Upland.

The city of Tacoma, Wash., will expend between $300,000 and $400,000 on machinery for its new power plant. Chief Engineer H. F. Gronen desires to purchase direct from manufacturers.

The Pacific Gas and Electric Company, San Francisco, Cal., will absorb the Great Western Power Company and build a hydro-electric plant on Feather river, near Oroville, Cal., to cost $10,000,000.

Senator William A. Clark, California, will erect a large building and home for the Young Women's Christian Association, Los Angeles, Cal., to cost $150,000. Steam-heating equipment, etc., will be required.

Proposals will be received until 10 o'clock a.m., December 15, for installing a cold-storage and ice plant in power house in new artillery post, Fort Sill, Okla. Information can be had of Capt. David L. Stone, constructing quartermaster, Fort Sill.

The Cholpeck Fish Company, Seattle, Wash., will build a cold-storage, freezing and general fisheries plant on Puget sound. Extensive equipment will be required: the company will also install a gas producer and engines of 100 brake horsepower and 125 brake horsepower.

CANADA

Montreal will spend $1,500,000 for filtration machinery.

Pembroke, Ont., will install complete water-pumping machinery.

Marmora, Ont., will install a complete new electric-lighting plant.

Montreal will spend $1,000,000 enlarging its water-pumping plant.

Winnipeg is calling for tenders for 500-kilowatt motor-generator sets.

Roleau, Saskatchewan, will install a complete new waterworks system.

The Canadian Box and Barrel Company will build a new factory at Pembroke.

Creston, B. C., is in the market for machinery for building sewers and road.

The cooperage works of Taylor & White, St. John, N. B., was destroyed by fire.

Penticon, B. C., will buy machinery for developing electricity from water power.

G. A. Fraser, of Thamesville, will equip a large new canning factory at Blenheim, Ont.

The big mills of W. W. Paling, at Petrolia, Ont., destroyed by fire, will be reëquipped at once.

The British Columbia Electric Railway will equip a new power station at New Westminster, B. C.

Philip Saumures' big sash and door factory at Montreal, destroyed by fire, will be rebuilt. Loss, $100,000.

The Brown Milling Company will spend $500,000 equipping a big mill in Toronto with the latest machinery.

Vancouver, B. C., will spend $500,000 improving its sewage system and much modern appliance will be bought.

The East Canada Power and Pulp Company will erect a mill on the Malbaie river, above Murray bay, Quebec, to cost $500,000.

MINING

The Gold Road mine, Mohave county, Ariz., will double the capacity of its mill.

Hoisting apparatus and machinery will be required at the Refugio mine, Parral, Mexico.

The North Star & Central mines, in Grass Valley, Cal., will enlarge the capacity of its stamp mill.

The Wickam mine, in the Grass Valley district, Cal., contemplates the installation of new machinery.

The Ely Consolidated Mining Company, near Ely, Nev., will install new power-plant machinery at its mine.

The Victoria Mining Company, operating the Esmeralda mine, near Cananea, Mexico, will install a 10-stamp mill.

W. E. Scott, operating quartz property near Ehernburg, Ariz., will soon be in the market for a 10-stamp mill equipment.

The Sixteen-to-One mine, in the Grass Valley district, Cal., will install an electrically operated hoist and pumping apparatus.

The Oneida Mining Company, operating at Pot Holes, near Yuma, Ariz., will make extensive improvements in its equipment.

A. C. Stanley, San Jose, Cal., operating the Roseberry claims, near Otis, Cal., will make extensive improvements in this district.

C. I. McReynolds, Cananea, Mexico, interested in the Santa Teresa Silver mine, of Sonora, will make large improvements in this district.

The Gold Crown mines, near Kingman, Ariz., is erecting a 100-ton reduction plant. This will be increased to 400 tons in the near future.

The hoisting works of the Pittsburgh mine, near Nevada City, Nev., were destroyed by fire. Loss, $10,000. The plant will be immediately rebuilt.

The Gold Consolidated Mining Company, Goldfield, Nev., is making extensive improvements in its equipment and power-plant apparatus at its mines.

The Sonora Copper Company, Cobre Grande, near Noria, is building a 100-ton smelter. It will also install an aërial tramway 3500 feet long of 500 tons capacity.

The New La Paz Gold Mining Company, near Ehernburg, Ariz., contemplate extensive improvements on its property. Machinery and a gas engine will be installed.

BUSINESS ITEMS

Edgar Allen & Co., Ltd., have appointed Schrock & Squires, 291 Pearl street, New York City, eastern agents for the sale of Allen tool steels.

Tate, Jones & Co., Inc., have received an order for their fuel-oil burning equipment for open-hearth furnaces, to be placed at the plant of the Mackintosh-Hemphill Company, Pittsburg, Penn.

John D. Sells, general manager of the Royersford Foundry and Machine Company, has just returned from a three months' business trip to Europe. He has opened a branch at 149 Queen Victoria street, London, E. C., Theodore Butler, manager, for the sale of the Sells roller-bearing and power-transmission machinery.

TRADE CATALOGS

C. S. Dodge, 67 Payne street, Lowell, Mass. Circular. Lowell heavy-duty back geared crank shaper. Illustrated.

McGraw-Hill Book Company, 239 West Thirty-ninth street, New York. Catalogs. New and standard books. Iron and steel. Civil Engineering.

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio. Catalog No. 22. Multiple stops for the engine lathe. Illustrated, 16 pages, 6x9 inches.

Lawlor Improved Jarring Molding Machine Company, 901 Century building, Pittsburg, Penn. Catalog A. Lawlor improved jarring molding machine, movable combined jarring and squeezing machine. Illustrated, 6x9 inches.

FORTHCOMING MEETINGS

The next meeting of the executive committee of the National Metal Trades Association will be held at Hotel Astor on December 6. The annual meeting on April 14, 1911, at the same place. The quarterly meeting of the Cincinnati, Ohio, branch will take place at the Business Men's Club, on the evening of December 8.

American Society of Mechanical Engineers, annual meeting, December 6-9, New York. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Society of Automobile Engineers, annual meeting, January 11 and 12, New York City; C. F. Clarkson, secretary, 1451 Broadway, New York City.

The National Civic Federation, eleventh annual meeting, January 12-14, New York City; D. L. Cease, secretary, 1 Madison avenue, New York City.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed with-

out notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

MISCELLANEOUS WANTS

Caliper catalog free. E.G.Smith, Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

The "Gas Saver" brazing forge; circular. J. L. Lucas & Son, 2 Fox St., Bridgeport, Ct.

Wanted—Work for screw machines and gear cutter. Box 775, AMERICAN MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery designed; drafting, tests, reports. Reliance Eng. Co., 113 Beekman street, New York City.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Wanted—Spur gear cutter to take 8-foot gears; state condition fully and where can be seen. Dillon-Box Iron Works Co., Denver, Colo.

Wanted—Designing, detailing and tracing work on engines, machinery, tools, automobiles and structures; shop plans and equipment. Clark & King, 615 Brisbane Bldg., Buffalo, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, AMER. MACH.

Nutter & Barnes Company, Boston, Mass., have one of the best equipped machine shops and solicit lathe, planer, milling machine, turret lathe, drill, gas engine or automobile machine parts work, by day or contract.

Belgium—A leading firm for the construction of steam engines in Belgium, having first class machinery of the latest design and a perfect business organization is prepared to manufacture engineering specialties. Address Box 254, AMERICAN MACHINIST.

Partnership wanted by experienced steam and mechanical engineer in good equipped machine shop in or near Chicago; expert designer on marine, Corliss and high speed engines, turbine compressors, rotary pumps, condensers, hoisting engines, mining and general machinery; highest references. Box 253, AMERICAN MACHINIST.

HELP WANTED

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—By a concern in Connecticut, a toolmaker accustomed to wire forming machinery, to take position as foreman in manufacturing department; good position for the right man. Box 245, AMERICAN MACHINIST.

IOWA

WANTED—Experienced superintendent to take charge of plant employing 50 men; steady job, good future; commence work January 1; state age, experience and salary first letter. Chamberlain Machine Works, Waterloo, Iowa.

MASSACHUSETTS

Head draftsman and designer, experienced on rotary printing presses and folders. Box 132, AMERICAN MACHINIST.

Pattern storage man wanted at once; must understand drawings and be familiar with patterns. Deane Steam Pump Co., Holyoke, Mass.

A company, building high grade machine tools which they sell direct, require men who have the ability to make first class demonstrators; they must have mechanical ability, be diplomatic and persistent; the right men will be given a course of instruction in the shop, and a good position; unmarried men preferred; give full information as to experience, age, etc. Box 233, AMER. MACHINIST.

MICHIGAN

Wanted—Superintendent for drop forge department, employing fifty to sixty men; steam and board hammers and upsetters; manufacture axles, crank shafts and general forgings; want a hustler who can get out production and handle men; factory located in lower Michigan; state age, experience, references, salary desired and where employed; correspondence confidential. "Drop Forge," AM. M.

NEW YORK

Wanted—Young man for erector and demonstrator of high grade line of machine tools; splendid opportunity if competent. Box 249, AMERICAN MACHINIST.

Wanted—First class machine tool salesman, with practical experience preferred; must be alive and competent to produce results. Box 247, AMERICAN MACHINIST.

Wanted—Young, active sales manager to sell machine tools and special machinery; state age, experience, references and salary expected. Box 248, AMERICAN MACHINIST.

Wanted—Northern New York, competent, detail, gas engine draftsmen; $15 per week; state age, training, full details, last five years work with salaries received. Box 221, AM. M.

Wanted—Two first class horizontal boring mill hands; must be competent to produce rapidly, first class accurate work; good opportunity; permanent position if competent. Box 246, AMERICAN MACHINIST.

Wanted—Superintendent to take charge of plant employing 200 men, manufacturing a varied line of machinery; an energetic man, proficient in speeding help and producing highest grade of work at lowest cost. Box 240, AMERICAN MACHINIST.

General superintendent wanted by engineering foundry and machine company, long established with annual business about $1,000,000; short distance from New York City; 500 men; salary no limit to proper person. "G. S.," Care AMERICAN MACHINIST.

First class salesman, iron and steel for special lines, having trade in New Jersey, New York State, eastern Pennsylvania and New England; state experience and salary expected; good opportunity to right party. Address "Steel Specialist," AMER. MACHINIST.

German mechanical engineer wanted; to introduce American hydraulic apparatus in Germany; must possess technical education, some American experience and suitable references. Address by letter only, stating salary desired. T. L. Van Norden, 90 West St., New York City.

OHIO

Wanted—Boring bar and boring mill men at once; night shift; state age and experience. The Heisler Company, St. Marys, Ohio.

Foreman wanted on erecting floor in locomotive works; state age, experience and address. Box 208, AMERICAN MACHINIST.

Wanted—Experienced crane erectors; steady employment; give reference, state experience and name wages desired. Box 244, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England building, Cleveland, Ohio.

PENNSYLVANIA

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Expert tool designer, having shop experience as well as technical training in pressed steel work to take charge of tool drafting room for large stamping plant in Milwaukee; unusual opportunity for an ambitious and capable man; state salary and past experience. Box 166, AMERICAN MACHINIST.

SITUATIONS WANTED

Classification indicates present address of advertiser, nothing else.

INDIANA

Mechanical engineer open for engagement as master mechanic, or superintendent; 24 years' experience in shop and factory management; designer of special machinery and appliance for cost reduction; good manager of men; live wire and a hustler; wants something big. Box 235, AMERICAN MACHINIST.

MASSACHUSETTS

Machine designer, American, with family, age 32, devoted 15 years to study and experience, specialized in the design of automatic machinery, wishes position of redesigning equipment or working up new machinery; experience has been largely in work of screw machine nature; desire salary $40 per week, with moving expenses; have been with present employer seven years; list of employers and salary paid for past 15 years, given for reference. Box 243, AM. MACH.

MICHIGAN

Superintendent or foreman of drop forge department; fifteen years' experience and can give best of reference; will go anywhere, East or Middle West. Box 238, AM. MACH.

NEW JERSEY

Cost accountant or take entire charge of office; 11 years' experience in machinery line; best references. Box 234, AMER. MACHINIST.

NEW YORK

Master mechanic wants position at $2000; age 37. Box 236, AMERICAN MACHINIST.

Water meter engineer and chief draftsman desires to make change. S. E. Boynton, 210 Railroad Ave., Brooklyn.

Draftsman, 25, desires to change; gas engine line preferred; seven years' experience. Box 239, AMERICAN MACHINIST.

Chief draftsman and general foreman, practical mechanic, now employed, would like a position in Greater New York. Box 237, AMERICAN MACHINIST.

Situation wanted with oxy-acetylene welding plant doing repair work; a general manager; knows how to produce results; will also consider an outside position. Box 241, AM. M.

Mechanical engineer, expert mechanic and designer, broad experience in designing, manufacturing and layout of tools, increasing production in machine shop and manufacturing plant, desires position. Box 252, AM. M.

In West, Middle or Southwest, position requiring a high grade man with brains, initiative, ability and experience; salary secondary consideration; engineering, mining or manufacturing. Box 226, AMERICAN MACHINIST.

Superintendent and master mechanic desires change; expert sheet metal lines; special knowledge black shapes, seamless or pieced enameling or galvanizing; executive and mechanical ability; uptodate tool and die designing. Box 242, AMERICAN MACHINIST.

OHIO

Engineer, 32 years old, graduate of a German technical college, 10 years' practical experience, steam engine pumps, tools and mill weighing, used to control of men of different nationalities, possessor of several languages, desires appointment as superintendent or head foreman. Box 250, AMER. MACHINIST.

FOR SALE

For Sale—One patent and one patent pending on heavy machine tools; no competition, some in operation; will sell for cash, or part cash; balance as royalty. Box 193, AM. MA.

For Sale—Successful uptodate plant, located in splendid city in Ohio, operating automatic screw machines in the production of special screws, nuts, etc.; $16,000 required; control owned by general manager and treasurer whose salary is $2700 can be purchased for $3000; an unusual opportunity for a man of ability with $3000 who can secure $13,000 outside capital. Box 251, AMER. MACHINIST.

For Sale—In New York State, small foundry and machine shop, with business readily increased by personal attention of proprietor; in midst of a group of nine large industries (paper, lumber, pulp, electric power and metal reduction), whose call for iron and bronze castings and prompt repairs is favored by nearness; surplus water power and room for additional buildings; value about $20,000; details on application; owner has other interests. "H. P. C.," AMERICAN MACHINIST.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

Talks With Our Readers

By the Sales Manager

AMERICAN MACHINIST:

"It is difference of opinion that makes horse racing possible" and it is because of an honest difference of opinion that each of several different manufacturers can properly speak of his own machine as "best." But when it comes to a statement of just what that particular machine will do—something that can be positively settled by a test—let us by all means have the exact result of the test.

An advertisement in the AMERICAN MACHINIST some time ago carried the prominent caption "10 times faster than any other method." There is nothing in the advertisement to conflict with the natural inference that this statement holds good for any work within the specialized range of the machine. I had my doubts about the saving being as great as this, and as one of the machines in question is in operation in our factory, decided to look up its record.

I found that in general it is a very efficient tool, but in no case is it "10 times faster" than our former methods, and in some cases we are actually beating the special machine at its own game. For example, we are machining four pieces simultaneously in a jig of our own design at an average rate of two minutes per piece; the best we can do on the special machine is three minutes each.

Another manufacturer advertises a machine to "reduce labor costs 50 to 500 per cent." A reduction of any quantity by 100 per cent. leaves nothing at all; then why make the meaningless and ridiculous claim of 500 per cent. reduction?

The AMERICAN MACHINIST is one of our strongest advocates of selling copy. This I take to be copy which is 100 per cent. salesmanship—copy which tells the strong points of the machine—copy which is of actual news value to the reader. We do not want copy 50 per cent. salesmanship, which would understate the merits of the machine—nor do we want 150 per cent. salesmanship, which would just as badly overstate. Good copy will convince, but exaggerated statements will cause the reader to double discount the whole.

H. M. WOOD,
The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio.

* * *

The AMERICAN MACHINIST is not only one of the strongest advocates of selling copy but of truth-telling copy.

There is less and less exaggeration in advertising.

Such statements as those referred to by Mr. Wood are now the exceptions in the AMERICAN MACHINIST rather than the rule—its advertising is more truthful, honest, sincere.

There was a time when people used circus hot-air expressions, because somebody said that Barnum said people liked to be fooled.

Barnum didn't win by fooling the people.

He advertised the greatest show on earth, and he had the goods.

Honesty is the first law of business.

Honesty is the first rule of true success.

Nowadays, exaggeration defeats its own ends.

The era of truth telling is here, if for no other reason than it costs money to be a liar.

Just as fast as that truth comes home to the man who pays the bills, is advertising paying better.

The man who is determined to get the best returns for money spent in advertising will never wilfully publish an untruth.

And even if he is short-sighted enough to want to, he can't if we know it.

* * *

Unreliable or false advertising has no place in the AMERICAN MACHINIST—

Our readers are more and more appreciating this and realizing that they are safe when they buy equipment advertised in the AMERICAN MACHINIST.

* * *

Only reliable goods can be continuously advertised.